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Division of Blister Rust Control
618 Realty Bldg.
Spokane, Wash.

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B L I S T E R R U S T W O R K
I N T H E F A R W E S T

January 1 to December 31, 1928.

Spokane Branch
Office of Blister Rust Control
618 Realty Building
Spokane, Washington

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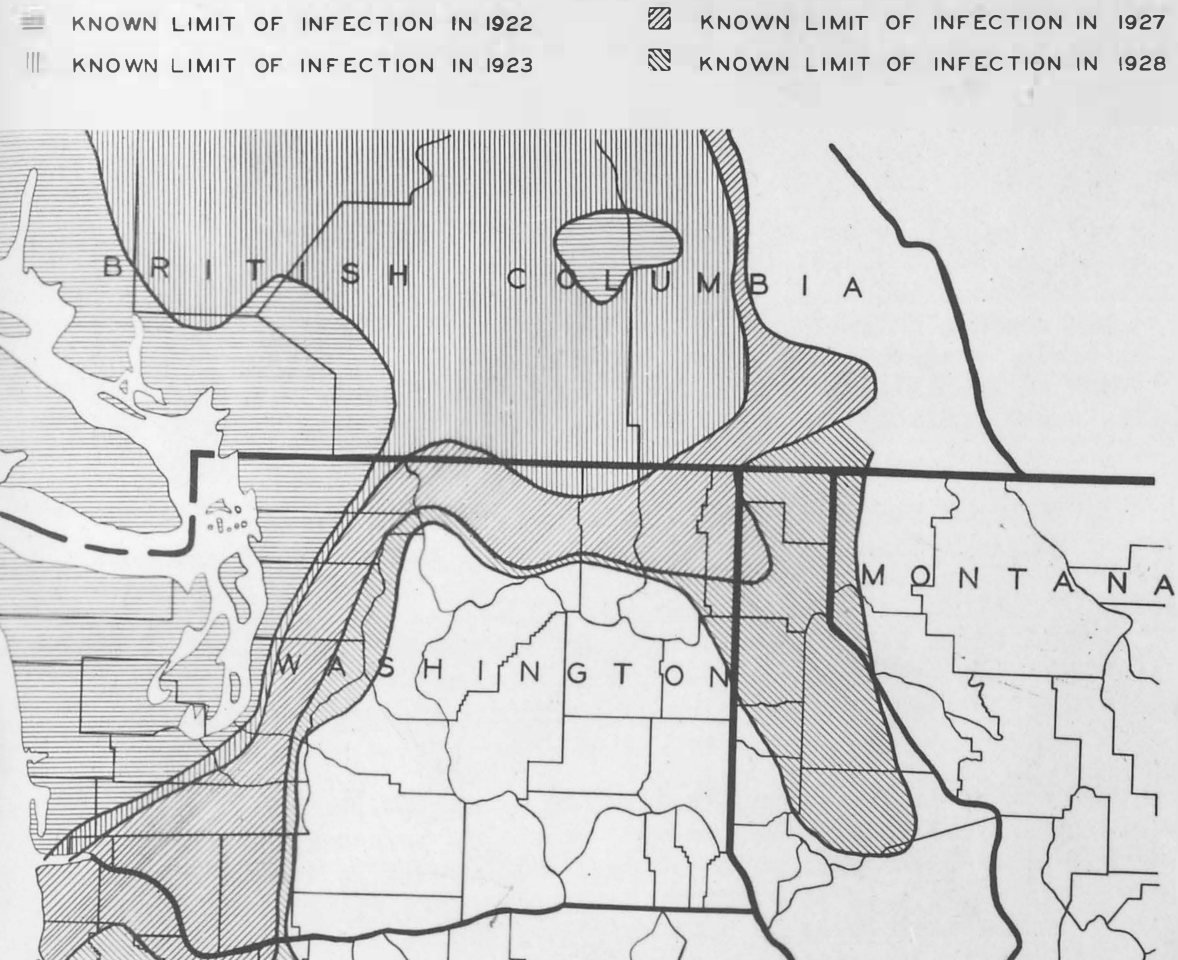
KNOWN SPREAD OF WHITE PINE BLISTER RUST IN THE WEST



BLISTER RUST WORK
IN THE FAR WEST

January 1 to December 31, 1928.

* * *

INTRODUCTION

The year of 1928 was signalized by one of the most far reaching, and undoubtedly the most important extensions of blister rust infection thus far encountered in the West. Atmospheric conditions were favorable to long distance spread and pine infection centers had evidently developed to such a point as to provide the necessary volume of aeciospores. General spread was particularly significant in that it was in every case in the direction of the most important commercial areas of susceptible pines.

During the spring of 1928 a well developed focus of pine infection was discovered at Newman Lake, Washington, approximately twenty-five miles east of Spokane and at the very border of the main Idaho white pine belt. Later in the season the rust was found to be generally present on Ribes thruout the commercial range of white pine in north Idaho. These infections were for the most part confined to the two most susceptible species, Ribes petiolare and Grossularia inermis, and were confined to the stream type, the natural habitat of these species.

The aecial source of these Ribes infections is not known. The pine infection center at Newman Lake was altogether too limited to account for the amount of Ribes infections found at numerous distant points. The possibility exists that other small focuses of pine infection are now present at various points in north Idaho in sufficient number to account for the southernmost Ribes infections. Those in the extreme northern end of the white pine belt could readily have come from the vicinity of Nelson, British Columbia.

During the course of 1928 pine infection was discovered at two points in northwestern Oregon, Larch Mountain and the west slope of Mount Hood. During the autumn the rust was found on Ribes bracteosum as far south as Yachats in Lincoln County, approximately half way down the Oregon coast. This constitutes a very considerable extent of the rust toward the sugar pine stands of California.

The program of work for 1928 centered around the general projects already under way. Further progress was made in cultivated black currant eradication in California. Large scale reconnaissance operations were carried on in north Idaho and northwestern Montana. The experimental develo ment of the local control in north Idaho consisted of a number of sub-

projects ranging from technical investigations in the toxicity of various chemicals as possible Ribicides, and studies in Ribes ecology to the experimental application of local control both by hand pulling and chemical means. Similar work in the development of local control was carried on in the sugar pine forests of California on a smaller scale.

The discovery of the rust over the entire Idaho white pine belt led to necessary minor adjustments in the program. It had previously been recognized that a general program of stream type eradication was the first necessary step in the general application of local control in the Inland Empire. This conclusion was further substantiated by the fact that in the course of its 1928 spread the rust on Ribes was almost entirely confined to the stream type. In order to prepare for any stream type eradication operations which might be considered necessary in 1929, the experimental field program was pushed thru as rapidly as possible and was continued to a much later date in the fall than is ordinarily the case. The program of investigation of Ribicides was also immediately developed to a much greater degree in order to secure the needed results as soon as possible.

The activities of the Western Branch of the Office of Blister Rust Control for the calendar year 1928, the period covered by this report, were conducted from funds available for two Federal fiscal years as shown below:

From January 1, 1928 to June 30, 1928, the applicable appropriation was "38133.14, Salaries and Expenses, Bureau of Plant Industry, Blister Rust Control, 1928" in the amount of $260,000.00 (for the entire fiscal year 1928) allotted as follows:

Project	For the Period 7/1/27 to 6/30/28.
A. Delaying spread of blister rust	
1. Eradication of cultivated black currants in Idaho, Washington and California...........	$16,071.67
2. Quarantine inspection (West only).............	9,350.00
3. Field surveys and inspection of nurseries in Oregon...	4,335.00
4. Field surveys in northwestern states to determine location of dangerous centers of pine infection and to follow the natural advance and establishment of blister rust in the northern area...	14,473.33
B. Development and application of local control	
1. National forests of northeastern Washington, Idaho and northwestern Montana................	53,215.00
2. Local control on state and private land, dollar for dollar cooperation between Federal Government and timber owners.........................	11,055.00

Project (Continued)	For the Period 7/1/27 to 6/30/28
3. Control reconnaissance in Idaho, Montana and northeastern Washington	$ 14,766.67
4. Studies of local control and its costs in California	13,310.00
5. Control reconnaissance and Ribes survey, California sugar pine areas	7,000.00
6. Studies of local control and recheck of 1925 eradication area, Oregon	6,095.00
C. Investigational work, Office of Forest Pathology	21,500.00
D. Experimental work on chemical eradication and studies on Ribes ecology	24,065.00
E. Educational work	6,313.33
F. Field supervision, maintenance of Spokane Office, miscellaneous supplies	19,950.00
G. Mississippi Valley quarantine work, maintenance of Washington office, Departmental reserves	38,500.00
Total	$260,000.00

From July 1, 1928 to December 31, 1928, the applicable appropriation was "39133.14, Salaries and Expenses, Bureau of Plant Industry, Blister Rust Control, 1929" in the amount of $233,500.00(for the entire fiscal year 1929) allotted as follows:

Project	For the Period 7/1/28 to 6/30/29.
A. Delaying spread of blister rust	
1. Eradication of cultivated black currants in Montana, Washington and California	$ 7,930.86
2. Field surveys and inspection of nurseries in Oregon	700.00
3. Field surveys in northwestern states to determine location of dangerous centers of pine infection and to follow the natural advance and establishment of blister rust in the northern area	11,695.65
B. Development and application of local control	
1. National forests of northeastern Washington, Idaho and northwestern Montana	62,222.32
2. Local control on state and private lands, dollar for dollar cooperation between Federal Government and timber owners	4,200.00
3. Control reconnaissance in Idaho, Montana and northeastern Washington	21,000.00

Project (Continued)		For the Period 7/1/28 to 6/30/29.
4. Studies of local control and its costs in California		$ 11,000.00
5. Control reconnaissance and Ribes survey, California sugar pine areas		5,500.00
6. Studies of local control and recheck of previously eradicated areas, Oregon		4,000.00
C. Investigational work, Office of Forest Pathology		21,500.00
D. Experimental work on chemical eradication and studies on Ribes ecology		26,923.32
E. Educational Work		5,945.85
F. Field supervision, maintenance of Spokane Office, Miscellaneous supplies		23,900.00
G. Miscellaneous		
General Control	$20,080.00	
Plant Disease Survey	500.00	
2% Department Reserve	4,268.00	
1% Bureau Reserve	2,134.00	26,982.00
Total		$233,500.00

The present organization of the Western Branch of the Office of Blister Rust Control partakes largely of a close centralization in which the work is all organized under direct supervision of the Spokane Office. The majority of the project leaders are permanently headquartered in Spokane. This close centralization is probably one step removed as such in the case of the state leaders for Montana, Oregon and California who are headquartered in those states as well as certain project leaders, due to facilities and conditions which make it possible to carry on certain work during the full year. Even though more and more work is organized locally in the various states, the general supervision to which the state leaders are subject will remain with the Western Branch Office at Spokane, Washington.

The following is the permanent western personnel which was employed during the period covered by this report:

1. Supervisory.

a. In charge of Western Branch Office, S. N. Wyckoff, Senior Pathologist.

2. Project Leaders.

a. Quarantine Inspection. C. R. Stillinger, Associate Pathologist.

b. Ribes Ecological Studies. W. A. Rockie, Assistant Pathologist.

2. Project Leaders (Continued)

c. Control Reconnaissance on Federal and Private Lands. J. L. Bedwell, Assistant Pathologist, assisted by M. C. Riley and P. B. Rowe, Junior Foresters; W. F. Painter and H. F. Geil, Agents; and G. M Whiting and R. E. Myers, Collaborators.

d. Experimental Ribes Eradication, Idaho.* C. C. Strong, Assistant Forester, assisted by P. S. Simcoe and W. G. Guernsey, Junior Foresters, and H. E. Swanson, C. O. Peterson, A. H. Glasgow and D. R. Payne, Agents.

e. Educational Work. R. L. MacLeod, Agent, assisted by Kermit Miller, Agent.

f. Studies on Spread of the Rust and Damage to Pine. H. N. Putnam, Associate Pathologist, assisted by E. L. Joy, Junior Forester.

g. Chemical Experiments. H. R. Offord, Agent, assisted by R. P. d'Urbal and G. R. Van Atta, Agents.

h. Experimental Chemical Eradication.* H. R. Offord, Agent, assisted by P. B. Bell, Junior Chemist, (resigned 10/8/28) and B. A. Ganoung and J. F. Breakey, Agents.

i. Cooperative Ribes Eradication.* J. L. Bedwell, Assistant Pathologist, assisted by B. A. Anderson, Junior Forester and H. L. Whiting, Agent, (resigned 7/8/28).

3. State Leaders.

a. Montana, C. H. Johnson, Assistant Pathologist.

b. Oregon, L. N. Goodding, Associate Pathologist, assisted by Mrs. M. S. Brierley, Assistant Stenographer.

c. California, G. A. Root, Assistant Pathologist, assisted by Project Leaders W. V. Benedict, Junior Forester (Eradication) with his assistant D. R. Miller, Junior Forester; F. A. Patty, Junior Pathologist (Ribes Ecology); and E. C. Kenyon, Agent (resigned 5/31/28), and T. H. Harris, Junior Forester (Reconnaissance). Stenographic work was performed by Mrs. Esther Buchman.

*For purposes of coordination and standardization of the various eradication projects (d, h and i) in the Inland Empire white pine belt, these were all placed under the supervision of C. C. Strong, Assistant Forester, during the past summer.

4. Clerical Work.

Roy Calhoun, Junior Administrative Assistant.

Miss M. L. McWold, Senior Clerk and Temporary Special Disbursing Agent, assisted by Mrs. M. C. Dowdy, Assistant Clerk.

Mrs. L. E. Klatt, Assistant Clerk-Stenographer.

Miss. Catherine Ryan, Junior Clerk-Stenographer.

Miss A. M. Fellows, Under Clerk-Typist.

Miss S. K. Millick, Under Clerk-Typist (resigned 10/20/28).

Miss E. K. Mellon, Junior Typist.

BLISTER RUST CONTROL WORK IN MONTANA
1928

Blister rust control work in Montana was carried on, as in the past, as a cooperative project between the Montana Department of Agriculture, Montana Forestry Department, School of Forestry, University of Montana, the Northern Montana Forestry Association and the Bureau of Plant Industry. The basic memorandum of understanding upon which this work was organized was made effective July 1, 1927 and can be found in the report for that calendar year. The following is the amendment to this memorandum to cover the work as organized for the Federal fiscal year 1929, beginning July 1, 1928:

"AMENDMENT TO
MEMORANDUM OF UNDERSTANDING
Effective July 1, 1927

Between
THE UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY
and the
MONTANA STATE DEPARTMENT OF AGRICULTURE - - - MONTANA STATE FORESTRY DEPARTMENT - - - the SCHOOL OF FORESTRY, UNIVERSITY OF MONTANA - - - and the NORTHERN MONTANA FORESTRY ASSOCIATION.

Cooperative Work in Controlling White Pine Blister Rust
in
MONTANA.
* * * *

"Paragraph F-6 of the Memorandum of Understanding described above contains the following:

> "'For the Fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $6,000, the Montana State Department of Agriculture approximately $5,000, the Montana State Forestry Department approximately $1,200, the School of Forestry, University of Montana, approximately $300, and the Northern Montana Forestry Association shall contribute in value approximately $1,000; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence.'

"In accordance with the foregoing provision, it is mutually agreed that for the fiscal year ending June 30, 1929, there will be expended by the Montana State Department of Agriculture approximately $5,000, by the Montana State Forestry Department approximately $1,200, by the School of Forestry, University of Montana, approximately $300, by the

Northern Montana Forestry Association approximately $1,000, and by the United States Department of Agriculture, Bureau of Plant Industry, through its Office of Blister Rust Control, approximately $18,700.00 in connection with cooperative blister rust control work in Montana.

Date:		Signature:
______	(s)	A. H. Bowman Commissioner, Montana Department of Agriculture.
July 6 - 28	(s)	Rutledge Parker State Forester, Montana Forestry Department.
July 6 - 28	(s)	T. C. Spaulding Dean, School of Forestry, University of Montana.
Oct. 12	(s)	A. E. Boorman Secretary, Northern Montana Forestry Association.
Oct. 26 1928	(s)	Wm. A. Taylor Chief, Bureau of Plant Industry."

CONTROL RECONNAISSANCE ON WHITE PINE TIMBER LANDS IN MONTANA - 1928

By
C. H. Johnson, Assistant Pathologist.

The season's work was confined chiefly to the Blackfeet and Flathead national forests and on private lands adjoining these forests. Some work was performed in the vicinity in 1926 so general working conditions and nature of territory was not entirely new.

Economic Development

Farming and lumbering are the leading industries in the region. The soil is fertile and capable of producing a great diversity of farm crops. The forests do not seem to be over-exploited. The tendency in this region is towards smaller sawmill units and closer utilization of the forest products which is evident by the tie treating plants and lath and shingle mills.

Accessibility

The territory is drained principally by the North, South, East, Middle and West forks of the Flathead River. All these drainages are large enough for water transportation of timber or river driving. Good roads and trails serve the region. The fire hazard is low in the general region as compared with other forests in western Montana. This is due to the greater rainfall and a well organized system of fire patrol as operated by the Forest Service and the Northern Montana Protective Association.

Ribes Conditions

The species of Ribes recorded on the area reconnaissanced are *Ribes lacustre, Grossularia inermis* and *R. viscosissimum*. *R. petiolare* bushes are known to occur although very sparsely. The average number of Ribes as typical of mixed stands are to be found in the region. *R. lacustre* bushes predominate and are found occurring along the more shaded streams and in open mature and open reproduction eradication types.

G. inermis are confined to the more open stream types and marshes; and *R. viscosissimum* occupies the exposed slopes. The absence of *R. petiolare* should be a helpful factor in reducing protection costs whenever Ribes eradication is attempted.

Private Lands

Detailed location:

T. 27 N., R. 26 W., Montana Meridian.
Sections 8, 9, 10, 11, 14, 15, 16, 17, 21, 22, 23, 26, 27, 33.

TABLE NO. 1

PER CENT OF TYPES COVERED BY RECONNAISSANCE - 1928.

Type	Acres	Per Cent
White Pine	3,230	36.05
Stream	90	1.0
Other	5,640	62.95
Totals	8,960	100.00

TABLE NO. 2

AGE CLASSES BY ERADICATION TYPES - WHITE PINE TYPE ONLY, 1928.

Eradication Types	Age Classes by Eradication Types								
	0-10	11-20	21-40	41-60	61-80	81-100	101-200	200+	Total
Dense Mature							2,483.5		2,483.5
Open Mature							70.0		70.0
Dense Pole			200	461.5					661.5
Open Pole									
Dense Repro.	15								15.0
Open Repro.									
Total	15		200	461.5			2,553.5		3,230.0

TABLE NO. 3

WHITE PINE AREA COVERED BY
INTENSIVE RECONNAISSANCE DURING 1928.

Eradication Types	Acres
Dense Mature	2,483.5
Open Mature	70.0
Dense Pole	661.5
Open Pole	
Dense Reproduction	15.0
Open Reproduction	
Stream	90.0
Total	3,320.0

Lolo National Forest

Detailed location:

T. 27 N., R. 26 W., Montana Meridian.
Sections 1, 2, 4, 8, 9, 11, 14, 15, 17, 19, 20, 22, 27, 29, 30.

TABLE NO. 4

PER CENT OF TYPES COVERED BY RECONNAISSANCE - 1928

Type	Acres	Per Cent
White Pine	2,640	27.50
Stream	100	1.04
Other	6,860	71.46
Total	9,600	100.00

TABLE NO. 5

AGE CLASSES BY ERADICATION TYPES - WHITE PINE TYPE ONLY - 1928

Eradication Types	Age Classes by Eradication Types								
	0-10	11-20	21-40	41-60	61-80	81-100	101-200	200+	Total
Dense Mature							460		460
Open Mature							160		160
Dense Pole						1,940			1,940
Open Pole									
Dense Repro.		80							80
Open Reprol									
Total		80				1,940	620		2,640

TABLE NO. 6

WHITE PINE AREA COVERED BY EXTENSIVE RECONNAISSANCE - 1928

Eradication Types	Acres
Dense Mature	460
Open Mature	160
Dense Pole	1,940
Open Pole	
Dense Reproduction	80
Open Reproduction	
Stream	100
Total	2,740

Flathead National Forest

Detailed location:

T. 29 N., R. 19 W., Montana Meridian.
Sections 1, 2, 12, 13, 14, 25.
T. 30 N., R. 19 W., Montana Meridian.
Sections 24, 25, 36.

T. 29 N., R. 18 W., Montana Meridian.
Sections 8, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 30, 31, 35, 36.

T. 28 N., R. 18 W., Montana Meridian.
Sections 1, 2, 3, 12, 13, 35, 36.

T. 30 N., R. 18 W., Montana Meridian.
Sections 4, 5, 7, 8, 17, 18, 19, 20, 30.

T. 31 N., R. 18 W., Montana Meridian.
Sections 32, 33.

T. 29 N., R. 17 W., Montana Meridian.
Sections 28, 29, 30, 31

T. 27 N., R. 17 W., Montana Meridian.
Sections 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 22, 23, 24, 25, 27, 28, 36.

T. 28 N., R. 17 W., Montana Meridian.
Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18, 19, 20, 21, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 35, 36.

T. 27 N., R. 16 W., Montana Meridian.
Sections 6, 7, 18, 29, 30, 31, 32, 33.

T. 27 N., R. 18 W., Montana Meridian.
Sections 1, 2, 3, 12.

T. 26 N., R. 17 W., Montana Meridian.
Sections 1, 2, 9, 10, 11, 12, 13, 14, 15, 16, 23, 24, 25, 26.

T. 26 N., R. 16 W., Montana Meridian.
Sections 4, 6, 14, 25, 36.

T. 26 N., R. 18 W., Montana Meridian.
Section 6.

T. 27 N., R. 18 W., Montana Meridian.
Section 31.

T. 26 N., R. 19 W., Montana Meridian.
Sections 2, 14, 15, 22, 23.

T. 28 N., R. 19 W., Montana Meridian.
Sections 8, 9,14, 15, 16, 17, 20, 21, 22, 23, 24, 26, 27, 28, 29, 32, 33, 34, 35.

T. 27 N., R. 19 W., Montana Meridian.
Sections 2, 3, 4, 5, 9, 10, 11, 12, 13, 14.

TABLE NO. 7

PER CENT OF TYPES COVERED BY RECONNAISSANCE - 1928

Type	Acres	Per Cent
White Pine	44,050	42.75
Stream	1,180	1.15
Other	57,810	56.10
Total	103,040	100.00

TABLE NO. 8

AGE CLASSES BY ERADICATION TYPES - WHITE PINE TYPE ONLY - 1928

Eradication Types	Age Classes by Eradication Types								
	0-10	11-20	21-40	41-60	61-80	81-100	101-200	200+	Total
Dense Mature							7,620		7,620
Open Mature							7,462		7,462
Dense Pole			839	14,339		1,517			16,695
Open Pole		1,680	1,428	669		2,644			6,421
Dense Repro.	320	4,620							4,940
Open Repro.	310	960							1,270
Total	630	6,902	2,267	15,008		4,161	15,082		44,408

TABLE NO. 9

WHITE PINE AREA COVERED BY EXTENSIVE RECONNAISSANCE - 1928

Eradication Types	Acres
Dense Mature	7,620
Open Mature	7,462
Dense Pole	16,695
Open Pole	6,421
Dense Reproduction	4,940
Open Reproduction	1,270
Stream	1,180
Total	45,588

Blackfeet National Forest

Detailed location:

T. 32 N., R. 20 W., Montana Meridian.
Sections 8, 9, 16, 17, 19, 20, 21, 22, 23, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36.

T. 31 N., R. 20 W., Montana Meridian.
Sections 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 16, 21, 24, 25.

T. 31 N., R. 21 W., Montana Meridian.
Sections 1, 2, 11, 12, 13, 14.

T. 31 N., R. 19 W., Montana Meridian.
Sections 3, 4, 5, 6, 8, 9, 19, 30.

T. 32 N., R. 19 W., Montana Meridian.
Sections 19, 23, 26, 27, 30, 31, 32, 33, 34, 35.

T. 33 N., R. 18 W., Montana Meridian.
Sections 11, 12, 13.

TABLE NO. 10

PER CENT OF TYPES COVERED BY RECONNAISSANCE - 1928
BLACKFEET NATIONAL FOREST.

Type	Acres	Per Cent
White Pine	26,237	64.06
Stream	552	1.34
Burn	1,486	3.63
Other	12,685	30.97
Totals	40.960	100.00

TABLE NO. 11

AGE CLASSES BY ERADICATION TYPES - WHITE PINE TYPE ONLY - 1928
BLACKFEET NATIONAL FOREST

Eradication Types	Age Classes by Eradication Types								
	0-10	11-20	21-40	41-60	61-80	81-100	101-200	200+	Total
Dense Mature						391	5,762		6,153
Open Mature							9,013		9,013
Dense Pole			2,917	570	1,460	429			5,376
Open Pole									
Dense Repro.	260	2,568							2,828
Open Repro.		2,867							2,867
Total	260	5,435	2,917	570	1,460	820	14,775		26,237

TABLE NO. 12

WHITE PINE AREA COVERED BY EXTENSIVE RECONNAISSANCE.

Eradication Type	Acres
Dense Mature	1,480
Open Mature	3,300
Dense Pole	540
Open Pole	
Dense Reproduction	
Open Reproduction	560
Stream	
Total	5,880

TABLE NO. 13

WHITE PINE AREA COVERED BY INTENSIVE AND EXTENSIVE RECONNAISSANCE

Eradication Type	Acres
Dense Mature	6,153
Open Mature	9,013
Dense Pole	5,376
Open Pole	
Dense Reproduction	2,828
Open Reproduction	2,867
Stream	552
Total	26,789

RIBES ERADICATION - SAVENAC NURSERY
HAUGAN, MONTANA

by

C. H. Johnson, Assistant Pathologist

Location of Area

The Savenac Nursery eradication area is located in Township 19 N., Range 30 W., Sections 14, 15, 21, 22, 23, 26 and 27, in the vicinity of Haugan, Montana. The project is readily accessible and may be reached by automobile over the Yellowstone National Highway, by rail on the Chicago, Milwaukee, St. Paul and Pacific transcontinental line and over a branch line of the Northern Pacific railroad extending from Missoula, Montana to Wallace, Idaho.

Purpose of Project

The principal purpose of the project was to give protection to a large crop of white pine seedlings, numbering about 3,000,000, which are raised annually and distributed as planting stock over the forests of the Northwest. With the blister rust spreading at such an alarming rate,the decision to protect this important source of supply was well timed.

Description of Area

The area is openly exposed to the elements with a gentle south and east slope assuring a maximum of sunlight as well as good drainage.

A fire occurring in 1910 destroyed all the standing timber in the immediate vicinity of the nursery. So severe was this fire that the ground cover was burned to the mineral soil thus destroying the Ribes seed which supposedly lie dormant in the duff. Ribes are found in profusion along the network of streams which surround the nursery thus necessitating our program of stream type eradication.

The cultivated portion of the nursery covers a narrow strip from north to south extending over four forties, or 160 acres. To sufficiently protect this small acreage required that two miles of stream type be eradicated on the Savenac Creek, an additional two miles along the St. Regis River, three quarters of a mile on Big Creek and correspondingly great distances on other minor drainages such as Timber Creek and East Fork, Dry Creek and West Fork and East Fork of Savenac Creek and McGee Creek.

Organization and Methods

Stream type Ribes eradication with chemicals and hand eradication were the methods employed. In addition to protecting the nursery, much of the work at Savenac was of an experimental nature with the object of securing cost data and working out methods which would be applicable to

other areas to be eradicated in the future.

The early season's organization consisted of two hand eradication crews with four men and a crew foreman comprising a crew. In the hand-spraying organization seven men with knapsacks, one man mixing chemicals and a crew foreman laying string lines, made up a unit. A man, experienced in chemical eradication, supervised the entire working of that unit.

The organization of the power spraying crew consisted of five nozzle men, a foreman, assistant foreman and a motor mechanic.

The methods used in hand pulling were similar to those which had been developed and proven successful by previous experience. Four men in line with the foreman checking proved quite practical. A string line marked the boundary of each strip completed. As the season progressed and men became experienced in detecting Ribes, two and three men units all working in line appeared to be very satisfactory. Tools used on hand eradication of Ribes were the army trench pick and mattock, depending on the character of Ribes growth. These tools were a part of the crew equipment.

About mid-season, when the heavier concentrations of Ribes for hand pullers had been covered, it became necessary to devise methods whereby they would be more efficiently employed. The hand pullers were grouped with the knapsack sprayers on one drainage and varied combinations formed, as: three hand eradicators and two knapsack men, three knapsack men and two hand eradicators, one hand and three knapsack men, and another crew of three knapsack men working as a unit. The two and three-man hand pulling crews were to eradicate the lighter concentrations. The single man was to act more as a scout and to remove single bushes and guide knapsack sprayers through the dense brush and beaver dams. The three knapsack sprayers working alone were to work out their own salvation on areas having heavier concentrations of Ribes.

As a result of this experiment the dead weight was quickly eliminated and after one day's operation it was quite conclusively proven that the units consisting of three knapsack sprayers were covering as large an areasas the units comprised of more men. Aided by some expert advice the three-knapsack unit working on a strip was further improved upon by each man having assigned him a block divided into four strips, approximately 1/4 chain wide. This last method placed a certain degree of responsibility upon each man, making him accountable for his own block, and further making it possible at any time to check the efficiency of the work done on a particular block or strip.

In the power spraying unit the assistant foreman checked on the nozzle men, laid extra main line, kept time records, and took general charge of operations when the foreman was not present. The motor mechanic

or operator mixed the chemicals and attended to the operation of the motor. The foreman mapped or checked over the areas to be sprayed, located filling stations, had chemicals distributed, assisted the motor mechanic, supervised moving operations and directed the activities of the knapsack men spraying the outlying areas.

At the beginning of the season with only five hundred feet of main line hose (in 100 foot lengths) the line was laid out its full length from the motor and the five man crew working as a unit sprayed back to the motor. This operation was repeated until all territory from this setup had been covered.

At the end of the season eleven hundred feet of main line hose and five laterals were used. The laterals were 1 - 200', 2 - 212', and 2 - 225' lengths. A main line hose was laid thru the center of the area and a main line cross lateral each 200 feet placed at right angles. The main line laterals were attached by a siamese and valves to the main line connections. The spraying crews were able to spray 200 feet and then reconnect their ¼" laterals at the next cross lateral on main line, thus spraying in a straight line the entire length of the main line.

The planning of operations was done by the foreman, reference being made to data supplied by the state supervisor in the way of maps and Ribes concentrations. A survey of the territory to be eradicated was made by the foreman, filling stations being located and the Ribes concentrations checked. From this data the method to be used was determined. The division of territory for power and knapsack work was determined at this time.

Two Ross Pumpers were used. The air cooling device was not sufficient to keep the piston and combustion chamber from becoming caked with carbon in a very short time. Possibly, the fuel used was responsible.

Two motors from the Pacific Marine Supply Company were used. The first was an old motor used the previous summer. The last was a new two cylinder air-cooled machine. It gave good service, yet showed the effect of carbon. It was not reconditioned until taken to Bovill, Idaho.

Two weeks was the maximum service for motors without overhauling and piston ring replacement.

At the beginning of the season the hose layout comprised 5 - 100 foot lengths of ¼" laterals and 5 - 100 foot lengths of ½" main line. During the latter part of the season this was increased to 2,148 feet of ¼" hose and 1,100 feet of main line.

Working Conditions

The past season was one of very light rainfall and consequently the streams in the vicinity of Savenac Nursery receded to their lowest level in many years. It was earlier anticipated that the beaver dams and extreme bogginess of the swamps would present some difficulty, but by the middle of August such places which normally were covered with from 12 to 18 inches of water had gone dry.

On upper Savenac Creek it appeared that the beavers were our constant enemy in retarding progress. Approximately sixty shots of dynamite were used to open up dams. Before shooting, the water in places was 6 to 8 feet deep, afterwards the water had drained to the mud level, presenting a more complex problem. Upon examination it was discovered that beavers cut the Ribes stems at the water surface. The supposition is that bushes cut in this manner would have died in two to three years. Shortly after the water was drained from the area, stems which had been out began sprouting and numerous Ribes seedlings made their appearance. It immediately became apparent that beavers were our best friends and were aiding us in eradicating Ribes. The shooting of beaver dams was discontinued. It is further hoped that the beavers will speedily reconstruct their dams.

Chemicals Used and Early Results

A 20 per cent solution of sodium chlorate, $NaClO_3$, was sprayed wherever R. petiolare were concentrated. However, on a greater portion of the Savenac area the two species R. petiolare and G. inermis were mixed with the tendency for G. inermis to predominate. This necessitated an increase in strength to a 30% solution. Early observations disclosed practically a complete kill on R. petiolare which was expected and the 30% solution on G. inermis appeared to have given equally good results.

Summary and Recommendations

Experience gained and opinions formed after the termination of a season's work leave the impression that knapsack spraying has a bright future. Present equipment must be improved and made more substantial and easier to carry and operate. The points in favor of knapsack spraying are reduction of overhead charges, ease in transporting equipment to new locations and the assurance of more continuous operation.

More time than seems necessary is lost in mixing chemicals. There exists the possibility that one man may mix his own solution in sufficient quantities to complete a block. Individual blocks may be larger, possibly an acre in size. In knapsack spraying there seems to be a general tendency to waste spray by shooting other than Ribes bushes and often shooting the same bush more than once. However, instructions at the beginning of the season by one experienced and familiar with spraying can aid to a great extent in overcoming this deficiency.

The following tabulations give the acreage on the various drainages by classification, method of eradication and concentration of Ribes:

TABLE NO. 1

SUMMARY OF RESULTS

Drainage	Area by Acres	Classification of Acreage Eradicated			Classification of Acreage Not Eradicated			Ribes Species As To Concentration			Method Used		
		Stream	Brush	Field	Stream	Brush	Field	R. pet.	G. inerm.	R. lac.	Hand Pulled	Power Sprayed	Knapsack Sprayed
Dry Creek	34.3	34.3						Heavy	Medium	Light	26.8		7.5
East Fork Dry Creek	14.0	14.0							Medium		14.0		
McGee Creek	16.1	8.2	7.9					Medium	Light	Light	6.2		9.9
Big Creek	82.0	25.3	11.5		22.6	22.6		Medium	Heavy	Light	5.3	19.5	12.0
St. Regis River	213.1	64.5	55.7	21.6	27.5	34.7	9.1	Light	Medium	Light	67.1	5.0	69.7
Savenac Creek	115.3	115.3						Medium	Medium	Light	47.7	46.6	21.0
East Fork Savenac Creek	11.0	11.0						Light	Light	Light	11.0		
Timber Creek	20.0	20.0						Light	Medium	Light	20.0		
West Fork Timber Creek	7.0	7.0						Light	Medium	Light	7.0		
Area Between Milwaukee & N.P. Tracks	99.6	16.2			8.6	10.5					64.3		16.2
Totals	612.4	315.8	139.4	21.6	58.7	67.8	9.1				269.4	71.1	136.3

TABLE NO. 2.

COST ANALYSIS - STREAM TYPE ERADICATION.

Method of Eradication	Total Acreage Eradicated	Time			Total Cost	Cost Per Acre
		Foreman Days	Asst. Foreman Days	Laborer Days		
Hand Eradication	269.4	57.55	117¼	419-7/8	$3,640.46	$13.513
Chemical Eradication	207.4	115.1	57¾	609-3/4	6,031.77	29.082
Combined Hand and Chemical	476.8	172.65	175	1029	9,672.23	20.285

TABLE NO. 3.

MEAL COSTS

Camp	Total Cost of Subsistence of Men	Total Number Meals Chargeable	Cost Per Meal
Savenac Nursery	$2,106.10	5,150	$ .409

SCOUTING FOR BLISTER RUST NORTHWESTERN MONTANA - 1928

By

C. H. Johnson
Assistant Pathologist

After the termination of the reconnaissance and eradication work several weeks of intensive scouting was conducted along the principal drainages. The season was very favorable for the spread of blister rust and it was generally expected that a larger number of aecial hits would be recorded for Montana. The first infection in Montana territory was found on the Kootenai National Forest a short distance from the Idaho line.

TABLE NO. 1

SCOUTING FOR BLISTER RUST NORTHWESTERN MONTANA SEPTEMBER AND OCTOBER, 1928

Locality	Ribes Species Examined	Number Inspected			Total
		R.pet.	G.iner.	R.americanum	
Bitter Root, Missoula River and tributaries	R.petiolare R.americanum G.inermis		940	60	2,200
Swan River and tributaries	G.inermis		560		560
Flathead River and tributaries	R.petiolare G.inermis	35	768		803
Stillwater Lakes	G.inermis		482		482
Fisher River and tributaries	G.inermis		460		460
Yaak River and tributaries	R.petiolare G.inermis	6	550		556
Kootenai River and tributaries	G.inermis		375		375
Bull River and tributaries	G.inermis		1,680		1,680
St. Regis River and tributaries	R.petiolare G.inermis	2,125	1,505		3,630
Blackfoot River and tributaries	R.petiolare G.inermis	350	400		750
Total		3,716	7,720	60	11,496

TABLE NO. 2

RECORD OF FIRST BLISTER RUST INFECTIONS FOUND IN MONTANA - 1928

County	Region	T.	R.	Sec.	Host Infected	Number Examined	Number Infected	Details Infection. % Leaves or No. Cankers & Year Wood	Pine Association	Situation Infected Bushes	Inspector	Date	Remarks
Lincoln	Payne Creek 100 yds from Bull Lake North of Noxon	29N	33W	29	G. iner	12	1	10%	Very Good	Full shade of deciduous growth 6' from stream	Putnam & Johnson	9/28	White Pine 11 to 20 under large trees within 150 feet.

BLISTER RUST CONTROL WORK IN IDAHO
1928

Blister rust control work in Idaho was carried on, as in the past, as a cooperative project between the Idaho State Department of Agriculture, University of Idaho. Idaho State Board of Forestry, Potlatch Timber Protective Association, Clearwater Timber Protective Association, Coeur d'Alene Timber Protective Association, Pend Oreille Timber Protective Association, Priest Lake Timber Protective Association and the Bureau of Plant Industry. The basic memorandum of understanding upon which this work was organized was made effective July 1, 1927 and can be found in the report for that calendar year. The following is the amendment to this memorandum to cover the work as organized for the Federal fiscal year 1929, beginning July 1, 1928:

"AMENDMENT TO
MEMORANDUM OF UNDERSTANDING
Effective July 1, 1927

Between
THE UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY
and the
IDAHO STATE DEPARTMENT OF AGRICULTURE - - - UNIVERSITY OF IDAHO - - - IDAHO STATE BOARD OF FORESTRY - - - POTLATCH TIMBER PROTECTIVE ASSOCIATION - - - CLEARWATER TIMBER PROTECTIVE ASSOCIATION - - - COEUR D'ALENE TIMBER PROTECTIVE ASSOCIATION - - - PEND OREILLE TIMBER PROTECTIVE ASSOCIATION - - - and the PRIEST LAKE TIMBER PROTECTIVE ASSOCIATION.

Cooperative Work in Controlling White Pine Blister Rust in IDAHO.

* * *

"Paragraph J-6, of the Memorandum of Understanding described above, contains the following:

"'For the Fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $78,000 to the support of this cooperative work, the Idaho State Department of Agriculture shall contribute in value approximately $1,100, the University of Idaho approximately $4,000, the Potlatch Timber Protective Association approximately $3,800, the Clearwater Timber Protective Association approximately $3,800, the Coeur d'Alene Timber Protective Association approximately $3,800, the Pend Oreille Timber Protective Association approximately $3,800, and the Priest Lake Timber Protective Association approximately $4,340; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence.'

"In accordance with the foregoing provision, it is mutually agreed that for the fiscal year ending June 30, 1929 there will be expended by the Idaho State Department of Agriculture approximately $2,500.00, by the University of Idaho approximately $4,200.00, by the Potlatch Timber Protective Association approximately $3,800.00, by the Clearwater Timber Protective Association approximately $3,800.00, by the Coeur d'Alene Timber Protective Association approximately $3,800.00, by the Pend Oreille Timber Protective Association approximately $3,800.00, by the Priest Lake Timber Protective Association approximately $4,340.00, and by the United States Department of Agriculture, Bureau of Plant Industry, through its Office of Blister Rust Control, approximately $91,000.00 in connection with cooperative blister rust control work in Idaho.

Date:	Signature:
June 26, 1928	(s) John S. Welch Commissioner, Idaho State Department of Agriculture.
7/4/28	(s) F. G. Miller University of Idaho.
July 17, 28	(s) Ben E. Bush State Forester, Idaho State Board of Forestry.
Aug. 2nd. 28	(s) A. W. Laird President, Potlatch Timber Protective Association.
Aug. 17-28	(s) Theo Fohl Secy-Treas., Clearwater Timber Protective Association.
Sept. 1-28	(s) Sig Hofslund Secretary, Coeur d'Alene Timber Protective Association.
Jany 18-29	(s) T. L. Greer Secretary, Pend Oreille Timber Protective Association.
Jan. 31-'29	(s) J. S. Barron Secretary, Priest Lake Timber Protective Association.
____________	____________ Chief, Bureau of Plant Industry. "

STUDIES IN RIBES ECOLOGY, IDAHO

by
W. A. Rockie
Assistant Pathologist

I. Definition

This project conducts research and investigation into the relations of Ribes to their environment. It investigates why, how, when and where Ribes do and do not grow.

Its application to the control program is two-fold, first, to furnish facts regarding Ribes which will aid in eradication, and second, to investigate the possibility of a forest management plan which will prevent or retard the inception and growth of new Ribes stands.

II. Methods

The field studies for 1928 were mainly centered in two general regions. Nine men were detailed to carry on these studies.

The temporary personnel began work as a single group in the vicinity of Harvard, Idaho. Ten days were spent here checking and examining previously established studies and establishing different experiments of the various types.

One man joined a field crew of the Priest River Experiment Station for the co-operative examination of their permanent quadrats.

A party of three men was stationed alternately at the Priest River Experiment Station and at Lakeview, Idaho where field studies were established and periodically checked.

A party of five men was stationed in the region of Harvard, Idaho for experimental studies in that and adjoining regions.

In addition to the necessary examinations of studies previously established, additional field experiments were begun. One new study, involving soil temperatures and soil moistures, was initiated during the past year.

The 1927 study "Restocking of Ribes" is included in the study entitled "Results of Duff Disturbance". Otherwise the 1928 studies represent a continuation of the 1927 experiments.

The field plans for the various studies are not given in exact detail in this report, except as they vary from the studies of the preceding year.

The 1928 field studies included the following individual experiments:

A. Controlled Plot Study of Ribes
B. Results of Duff Disturbance
C. Light-Moisture-Duff Study
D. Life Habits of Ribes
E. Ribes Seed Germination Tests
F. Leaf-area Live-stem Studies
G. Temperature-moisture Investigations

Each experimental study has been made as a separate unit, and the reports thereon will be presented in like manner.

III. Results

The results are listed under the individual reports of which they are a part.

IV. Costs

Salaries - - - - - - - - - - -	$7,749.15
Field Expenses- - - - - - - -	2,667.14
Miscellaneous Equipment & Supplies -	199.19
Total	$10,615.48

The costs of the various studies within the project are estimated as follows:

A. Controlled Plot Study of Ribes- - - - -	$3,184.65
B. Results of Duff Disturbance- - - - - -	1,592.32
C. Light-Moisture-Duff Study - - - - - - -	530.77
D. Life Habits of Ribes - - - - - - - -	1,061.55
E. Ribes Seed Germination Tests - - - - -	530.77
F. Leaf-area Live-stem Studies- - - - - -	1,061.55
G. Temperature-moisture Investigations - - -	2,653.87
Total	$10,615.48

A. Controlled Plot Study of Ribes

I. Definition

A controlled study of field conditions designed to show whether viable seeds of R. viscosissimum are present in or beneath forest duffs of different ages, or whether these viable seeds, from

which Ribes develop on forest areas, are recently deposited through some disseminating agency, such as wind, water, birds or rodents.

And, further, by studying such plants as they appear and grow under the controlled conditions, to determine under which conditions the seeds germinate, and to what extent such plants survive to maturity.

Also to determine the same facts regarding any other species of Ribes which may appear in the experimental plots thus established.

II. Methods

A complete set of experimental plots consists of 36 milacre units laid out as shown on page 133 in the 1927 annual report.

The entire area is enclosed within a 4-wire barbed fence.

Block I is not otherwise protected.

Block II is also protected by a fence of window screen, which is entrenched below ground, stands 3 feet above ground and is aproned outward at the top.

Block III is fenced identically with Block II. It is also tightly covered with a muslin roof which is supported by chicken wire.

Strip A of each block has R. viscosissimum fruits planted and staked at specified intervals.

Strip B of each block was not planted.

Plots #1 are check plots and were not disturbed.
Plots #2 have the undecayed upper duff removed.
Plots #3 have the entire duff mantle removed.
Plots #4 have the surface duff lightly burned.
Plots #5 have the duff moderately burned.
Plots #6 have the duff entirely burned.

These plans are carried out as nearly as practicable on a field basis, but it is recognized that not all specifications can be executed in field practice.

An individual controlled plot study may consist of any fractional number of the aforementioned set of plots.

III. Results

The following studies were established during the 1927 season:

TABLE NO. 1

1927 CONTROLLED PLOT STUDY AREAS

Serial No.	Name of Area	Areas Planted to Ribes	Number Milacres
1	Meadow Creek #1	*	16
2	Cedar Creek #1		4
3	Gold Hill #1	*	36
4	" " #2		5
5	" " #3		5
6	" " #4		12
7	Camp D #1		36
8	Pierce #1	*	36
9	Lakeview #1		36
10	" #2		36
11	" #3		36
12	" #4		36
Total for 12 areas			270

None of these areas showed germination from the planted fruits during that same year, but areas 1, 3, 4 and 5 showed fall germination of naturally seeded Ribes seeds during that season.

Almost all of these 1927 fall seedlings failed to survive the following winter. The death of these autumn seedlings was apparently, chiefly due (1) to frost heaving and (2) to actual freezing of the plant during the extreme cold weather.

In March, 1928, many of these seedlings were still standing upright, but some appeared to have been frozen. Other seedlings were still alive at that time, but the spring heaving of the soil took practically every remaining seedling before warm weather arrived.

Theoretically, the volunteer Ribes should be of equal numbers on the planted and unplanted plots. This factor is compared in Table No. 2.

TABLE NO. 2

VOLUNTEER RIBES ON PLANTED VS. UNPLANTED PLOTS

	No. Milacres as Basis		Volunteer Ribes Per Acre On Planted Plots	Volunteer Ribes Per Acre On Plots Not Planted
	Planted	Not Planted		
Undisturbed Check Plots	21	21	286	95
Plots With Top Duff Removed	24	24	12,166	20,291
Plots With All Duff Removed	24	24	7,208	23,750
Plots Lightly Burned	19	19	50,158	36,526
Plots Moderately Burned	10	10	41,500	19,600
Plots Heavily Burned	15	15	1,733	1,600
Average for all Plots	113	113	17,407	17,460

This table includes only those controlled plot studies which have a planted plot to check each unplanted plot.

The wide variations between the corresponding planted and unplanted plots indicate that a Ribes stand is composed of many individual Ribes concentrations, with areas between which have a low Ribes population. The uniformity of the general averages indicates that insufficient data are included to iron out these irregularities.

The results from the planted Ribes fruits are reported under Ribes Seed Germination Tests, another phase of this report.

The 1928 results from the 12 areas, as regards volunteer Ribes, are summarized in Table No. 3.

TABLE NO. 3

VOLUNTEER RIBES ON CONTROLLED PLOTS

Type of Plot	Number Milacres as Basis	Average No. Ribes Per Acre for All Areas	Maximum No. Ribes Per Acre for Any Milacre Plot	Minimum No. Ribes Per Acre for Any Milacre Plot
Top Duff Removed	49	18,000	149,000	0
All Duff Removed	50	15,120	146,000	0
Light Burn	41	44,976	237,000	0
Medium Burn	20	30,550	82,000	0
Heavy Burn	33	2,939	26,000	0
Average for All Disturbed Plots	193	21,829	237,000	0
Undisturbed Check Plots	45	511	13,000	0

The preceding table indicates the varying numbers of Ribes seeds present on adjoining plots within a forest area.

The presence of a few Ribes on the check plots indicates that extreme care in the establishment of this experiment would have been required to entirely prevent new Ribes plants.

Partial and complete removal of the duff appear about equally effective for inducing the germination of these seeds.

All degrees of intensity of forest fire appear sufficient to stock a burned area, although the heavy burns evidently destroy most of the seeds.

Table No. 4 indicates that fire is more effective and more consistent in producing new Ribes than is mechanical disturbance.

TABLE NO. 4

UNIFORMITY OF RIBES STANDS IN VARIOUS AREAS

Type of Plot	Per Cent of Milacre Plots Having More Than The Average No. of Ribes For All Plots of That Type	Per Cent of Milacre Plots Having Less Than The Average No. of Ribes For All Plots of That Type
Undisturbed Check Plot	15.5	84.5
Top Duff Removed	25.0	75.0
All Duff Removed	22.0	78.0
Light Burn	36.6	63.4
Medium Burn	45.0	55.0
Heavy Burn	33.3	66.7
All Disturbed Unburned Plots	23.5	76.5
All Disturbed Burned Plots	38.3	61.7
All Disturbed Plots	26.0	74.0

The triple arrangement of blocks for this field study was made primarily to find the differences, if any, between (1) areas on which birds and rodents had ready access, (2) areas on which birds only had ready access and (3) areas from which birds and rodents were excluded.

Table No. 6 illustrates the results of this phase of the study.

TABLE NO. 5

INFLUENCE OF BIRDS AND RODENTS UPON RIBES STANDS

Part 1
Including Equal Number of Plots of Equal Size

Description of Plots	Unfenced Plots Accessible to Birds & Rodents	Fenced Plots Accessible to Birds Only	Fenced & Roofed Plots Inaccessible to Birds & Rodents	All Plots
Average No. Ribes Per Acre on All Undisturbed Check Plots	*(12) 83	(12) 167	(12) 333	(36) 194
Average No. Ribes Per Acre On All Plots With Top Duff Removed	(14) 25,571	(14) 15,000	(14) 14,571	(42) 18,381
Average No. Ribes Per Acre On All Plots With All Duff Removed	(14) 10,571	(14) 20,714	(14) 18,429	(42) 16,571
Average No. Ribes Per Acre On All Plots of Light Burn	(10) 45,200	(10) 15,600	(10) 52,600	(30) 37,800
Average No. Ribes Per Acre On All Plots of Medium Burn	(6) 14,667	(6) 32,333	(6) 28,000	(18) 25,000
Average No. Ribes Per Acre On All Plots of Heavy Burn	(8) 1,125	(8) 1,250	(8) 250	(24) 833
Average No. Ribes Per Acre On All Controlled Plots	(64) 16,516	(64) 13,469	(64) 18,594	(192) 16,188

Part 2
Including All Controlled Plots

Description of Plots	Unfenced Plots Accessible to Birds & Rodents	Fenced Plots Accessible to Birds Only	Fenced and Roofed Plots Inaccessible to Birds & Rodents	All Plots
Average No. Ribes Per Acre On All Undisturbed Check Plots	*(16) 125	(12) 167	(17) 1,118	(45) 511
Average No. Ribes Per Acre On Alll Plots With Top Duff Removed	(17) 21,412	(12) 17,500	(19) 16,211	(48) 18,375
Average No. Ribes Per Acre On All Plots With All Duff Removed	(18) 10,833	(14) 20,714	(18) 15,555	(50) 15,120
Average No. Ribes Per Acre On All Plots of Light Burn	(14) 66,286	(10) 15,600	(17) 44,646	(41) 44,976
Average No. Ribes Per Acre On All Plots of Medium Burn	(8) 31,125	(6) 32,333	(6) 28,000	(20) 30,550
Average No. Ribes Per Acre On All Plots of Heavy Burn	(10) 2,200	(8) 1,250	(15) 4,333	(33) 2,939
Average No. Ribes Per Acre On All Controlled Plots	(83) 21,205	(62) 13,903	(92) 17,293	(237) 17,776

*Number in upper right hand corner of each division is "Number of Milacres as Basis".

Annual Report 1928
W. A. Rockie

The two parts of Table No. 5 show marked variations, but no striking differences. The differences are all caused by the few partial sets of controlled plots which are included in part 2. On some of these partial sets, an abnormally heavy stand of Ribes resulted.

These data indicate that birds and rodents play a minor part in the distribution of Ribes seeds.

In the 12 areas shown in Table No. 1 which have been combined for the data of Table No. 5, the average of these several situations is believed to be typical of the upland white pine sites of northern Idaho. The areas range in elevation from about 2,200 feet to about 4,500 feet.

On 10 of the 12 areas, only volunteer *R. viscosissimum* seeds germinated, while on the other 2 areas seeds of both *R. viscosissimum* and *R. lacustre* proved to be present.

Five of these areas are on the cooler sites within their immediate regions, six are on average sites, and one is situated on a warm slope.

Six additional sets of controlled plots were established in 1928, five on areas believed to have stored seeds of *R. lacustre* and one area believed to have seeds of *G. inermis* or *R. lacustre*, or both. No planting was done on these plots. All of these 1928 areas are established on cool sites. They are described in Table No. 6.

TABLE NO. 6

NEW CONTROLLED PLOT STUDY AREAS

Name of Area	No. Milacres	Direction of Slope	Age of Stand
Gold Hill Controlled Plot Study #5	5	Flat	Mature
" " " " #6	5	Flat	"
Hoodoo " " #1	12	N	30 Years
Exp. Sta. " " #1	12	N	80 "
" " " " #2	12	Flat	80 "
Santa " " #1	6	Flat	80-100 "

These areas are all established within type areas which are Ribes-free. They were closely checked this fall to learn the dates of

autumnal seed germination, but no germination occurred this year.

The meteorological records for 1927, when Ribes seeds did germinate, and for 1928, when they did not germinate, show the following outstanding differences: In 1927, abundant rains fell every week after August 28 until winter, while in 1928 there was practically no precipitation until late in October.

In 1927, new Ribes seedlings appeared above ground from September 4 until between October 15 and October 29, while in 1928 no new seedlings appeared.

The findings to date from this experiment are as follows:

1. Dormant seeds of R. viscosissimum and R. lacustre are present in or beneath the duff of many Ribes-free white pine stands.

   a. Severe ground fire kills most of these seeds.
   b. Moderately severe ground fire kills many of thes seeds.
   c. Light ground fire apparently kills few of these seeds.
   d. Removal of entire duff mantle permits the germination of these seeds.
   e. Removal of top duff mantle permits the germination of these seeds.
   f. The undisturbed check plot does not permit the germination of these seeds.

2. This delayed germination is apparently the result of temperature insulation.

3. These dormant Ribes seeds are apparently at the base of the duff mantle.

4. Rodents apparently do not play an important role in the spread of Ribes in northern Idaho.

5. Birds apparently do not play an important role in the spread of Ribes in northern Idaho.

6. The seasonal date of uncovering of mineral soil may cause a difference in the time of germination.

B. Results of Duff Disturbance

I. Definition.

A systematic examination of forest areas within which outside activities have disturbed the normal life of the forest. It may be duae to fire, logging, road or trail building, insect infestation or to any other factor which upsets the natural balance. A study of the germination of Ribes upon these disturbed areas is fundamental. The establishment, survival and growth of Ribes on such areas is a secondary phase of the investigation.

II. Methods.

A. Co-operative Studies.

In co-operation with the Priest River Experiment Station, U. S. Forest Service, numerous permanent quadrats on burned or logged lands in the Kaniksu region, were examined.

These quadrats were divided into two groups, covered screened plots from which seeding in after disturbance was excluded, and unscreened plots permitting all natural seeding to occur in its normal manner. The Experiment Station personnel was primarily concerned with the coniferous reproduction, while the blister rust man recorded the Ribes reproduction.

In co-operation with the University of Idaho School of Forestry, a number of sample plots in the Clearwater region of Idaho are under observation in the same manner.

B. Strip and Plot Studies.

Numerous plots and strips in various localities of the Idaho white pine region, established in 1926 and 1927, are included in this study.

These areas are studied simply to learn the range of conditions which prevail within the region.

Some of the strips and plots established in 1926 are one rod wide, others one-half rod wide, but all studies established since that time are based on the milacre unit.

C. Restocking of Ribes After Eradication

Methods of study are described in detail in the 1927 annual report on Page 189.

D. Logging Studies.

Studies were made of the resultant Ribes stands on several logging areas in various sections of the region, the data being recorded on detailed maps.

III. Results.

A. Co-operative Studies.

1. With Priest River Experiment Station.

On this study, 723 permanent quadrats were examined. These were divided into groups as follows:

459	unscreened	quadrats	of	1.0	milacre each.
18	"	"	"	.25	" "
36	"	"	"	2.5	" "
210	screened	"	"	.25	" "
723	Quads - Total				

TABLE NO. 7

RIBES ON EXPERIMENT STATION QUADRATS

Type of Quadrat	Area in Acres	No. Ribes in Quadrats	No. Ribes Per Acre
Unscreened	.5535	42	75.9
Screened	.055	5	90.9

The result of these studies indicates that current seeding is not a factor in the seedinggof Ribes following disturbance of the natural balance.

These studies in the Experiment Station region also indicate that the Ribes population in this region is much lower than in the St. Joe and Clearwater forest regions.

2. With University of Idaho.

Seven permanent one-acre plots have been established and all changes in their timber and Ribes population are closely observed for a period of years. One of the areas has been logged (Plot #7), others will be logged in the near future, and still others will remain unlogged as check plots. The data of these plots is given in Tabel No. 8.

TABLE NO. 8

UNIVERSITY OF IDAHO LOGGING PLOTS

Name of Plot	Area in Acres	R. viscosissimum per Acre				
		No. Bushes	Ft. Live Stem	Ft. Dead Stem	Ft. New Growth	No. Fruits
U. of I. #1	1.0	-	-	-	-	-
U. of I. #2	1.0	-	-	-	-	-
U. of I. #3	1.0	-	-	-	-	-
U. of I. #4	1.0	-	-	-	-	-
U. of I. #6	1.0	-	-	-	-	-
U. of I. #7	1.0	44	29.0	0.1	23.0	-
U. of I. #9	1.0	-	-	-	-	-

No summary of this study will be attempted until a succeeding year.

B. Strip and Plot Studies.

The burn study strips and plots are summarized in Table No. 9.

TABLE NO. 9

RIBES STAND ON MEDIUM VS. HEAVY BURNS

Description	Area In Acres	Ribes Per Acre		
		R. visco.	R. lac.	Total Ribes
Average for 11 Medium Burns	.224	7,991	49	8,040
Average for 32 Heavy Burns	2.87	875	223	1,098

Truly light burns do not usually occur in nature. Most forest fires result in a heavy burn, with frequent areas of medium burn scattered promiscuously through the burned area, according to the uses of those terms in this report.

The data taken on these numerous areas are additional corroboration of the results obtained on the controlled plot study areas.

C. Restocking of Ribes after Eradication.

This study in 1928 consisted only of areas established during the preceding year. Plots were examined carefully on the following areas:

Upper Lamb Creek - Kaniksu National Forest, Idaho.
Upper Binarch Creek " " " "
Little North Fork - Coeur d'Alene National Forest, Idaho.
Mary's River - Clarkia, Idaho.
East Fork Potlatch Creek - Bovill, Idaho.
Gold Hill - Harvard, Idaho.

The results of these investigations are summarized in Tables No. 10 to 15, inclusive:

TABLE NO. 10

RESTOCKING OF R. LACUSTRE AFTER ERADICATION
UPPER LAMB CREEK

Plot No.	1927 Record	1928 Record		
	1927 Plants Per Acre	1927 Plants Per Acre	1928 Plants Per Acre	Total Per Acre
1 A	39,000	22,000	8,000	30,000
1 B	-	-	-	-
2 A	286,000	75,000	43,000	118,000
2 B	-	-	1,000	1,000
3 A	32,000	7,000	-	7,000
3 B	1,000	-	-	-
4 A	20,000	3,000	16,000	19,000
4 B	-	-	-	-
5 A	35,000	28,000	1,000	29,000
6 A	37,000	26,000	15,000	41,000
Average of A Plots	74,833	26,833	13,833	40,667
Average of B Plots	250	-	250	250

NOTE: A Plots appeared to have been much disturbed in 1926.
B Plots appeared to have been little disturbed in 1926.

This table shows that 35.8% of the 1927 seedlings survived to their second year. It also shows that the 1928 germination was about 18% of that of 1927.

TABLE NO. 11

RESTOCKING OF RIBES LACUSTRE AFTER ERADICATION
BINARCH CREEK

Ribes Before Eradication	Plot No.	1927 Record	1928 Record		
		1927 Plants Per Acre	1927 Plants Per Acre	1928 Plants Per Acre	Total Per Acre
R.lacustre	1 A	200,000	120,000	8,000	128,000
"	1 B	92,000	40,000	20,000	60,000
"	2 A	72,000	56,000	40,000	96,000
"	2 B	-	-	-	-
"	3 A	124,000	32,000	136,000	168,000
"	3 B	4,000	4,000	8,000	12,000
"	4 A	32,000	8,000	20,000	28,000
"	4 B	-	-	-	-
"	5 A	156,000	40,000	20,000	60,000
"	5 B	4,000	-	12,000	12,000
Average of A Plots		116,800	51,200	44,800	96,000
Average of B Plots		20,000	8,800	8,000	16,800

NOTE: A Plots appear to have been much disturbed in 1926.
B Plots appear to have been little disturbed in 1926.

This tabl

This table shows that 43.8% of the 1927 seedlings survived to the second year. It also shows that the 1928 germination was about 38% of the 1927 germination.

TABLE NO. 12

RESTOCKING OF R. LACUSTRE ON SLOPELAND SITES AFTER ERADICATION, HONEYSUCKLE REGION

Plot No.	Acreage Basis	R. lacustre Per Acre Before Eradication	New R. lacustre Plants Per Acre in 1928		
			1927 Plants	1928 Plants	Total Plants
1	.08	462.5	-	-	-
3	.109	825.7	477.0	202.0	679.0
4	.184	190.2	-	-	-
5	.449	26.7	-	-	-
6	.1	190.0	-	-	-
7	.1	310.0	-	120.0	120.0
8	.1	570.0	-	320.0	320.0
All	1.122	250.45	40.53	51.44	91.97

TABLE NO. 13

RESTOCKING OF R. VISCOSISSIMUM ON SLOPELAND SITES AFTER ERADICATION, HONEYSUCKLE REGION

Plot No.	Acreage Basis	R. viscosissimum Per Acre Before Eradication	New R. visocissimum Plants Per Acre in 1928		
			1927 Plants	1928 Plants	Total Plants
1	.08	12.5	-	-	-
4	.184	923.9	-	-	-
5	.449	131.4	-	-	-
All	.713	322.58	-	-	-

Near Harvard, Idaho, an area of .1 acre supporting a heavy stand of R. viscosissimum was eradicated in 1927. This old stand was approximately 20 years old, and gave practically 100 per cent brush cover to the area.

There was no seedling reproduction of Ribes on this area in 1928.

A number of plots was established on the chemically eradicated stream bottom near Clarkia. The area covered by these plots was originally a solid mat of mature R. petiolare.

TABLE NO. 14

RESTOCKING OF R. PETIOLARE AFTER CHEMICAL ERADICATION
CLARKIA, IDAHO

Plot No.	1927 Record	1928 Record		
	1927 Plants	1927 Plants	1928 Plants	Total No. Ribes
1 A	77,000	2,000	-	2,000
2 A	33,000	-	-	-
3 A	83,000	4,000	2,000	6,000
1 B	71,000	1,000	2,000	3,000
2 B.	140,000	*	7,000	7,000
3 B	192,000	19,000	8,000	27,000
Average of All Except 2 B	91,200	5,200	2,400	7,600

* All the 1927 seedlings on this plot were pulled in the fall of 1927.

This table shows that only 5.7% of the 1927 seedlings survived until their second year. It also shows that the 1928 germination was but 2.6% as great as the 1927 germination.

An area of 1 square chain on the 1927 sprayed area of stream type near Bovill, Idaho was examined in 1928.

TABLE NO. 15

RESTOCKING OF RIBES AFTER CHEMICAL ERADICATION
BOVILL, IDAHO

Plot No.	Area In Acres	1928 Ribes per Acre			
		R. petiolare	R. lacustre	G. inermis	Total
1	0.1	210	120	-	330

These various studies of the restocking of Ribes after eradication indicate the following to be facts:

Following hand eradication on upland areas:

a. R. viscosissimum seldom, if ever, produces new seedling Ribes to restock the area.
b. R. lacustre frequently produces new seedling Ribes to restock the area.

Following hand eradication on alluvial bottoms;

a. R. lacustre usually produces many new seedling Ribes to restock the areas.

b. Reaction of R. petiolare and G. inermis not yet known.

Following chemical eradication on alluvial bottom:

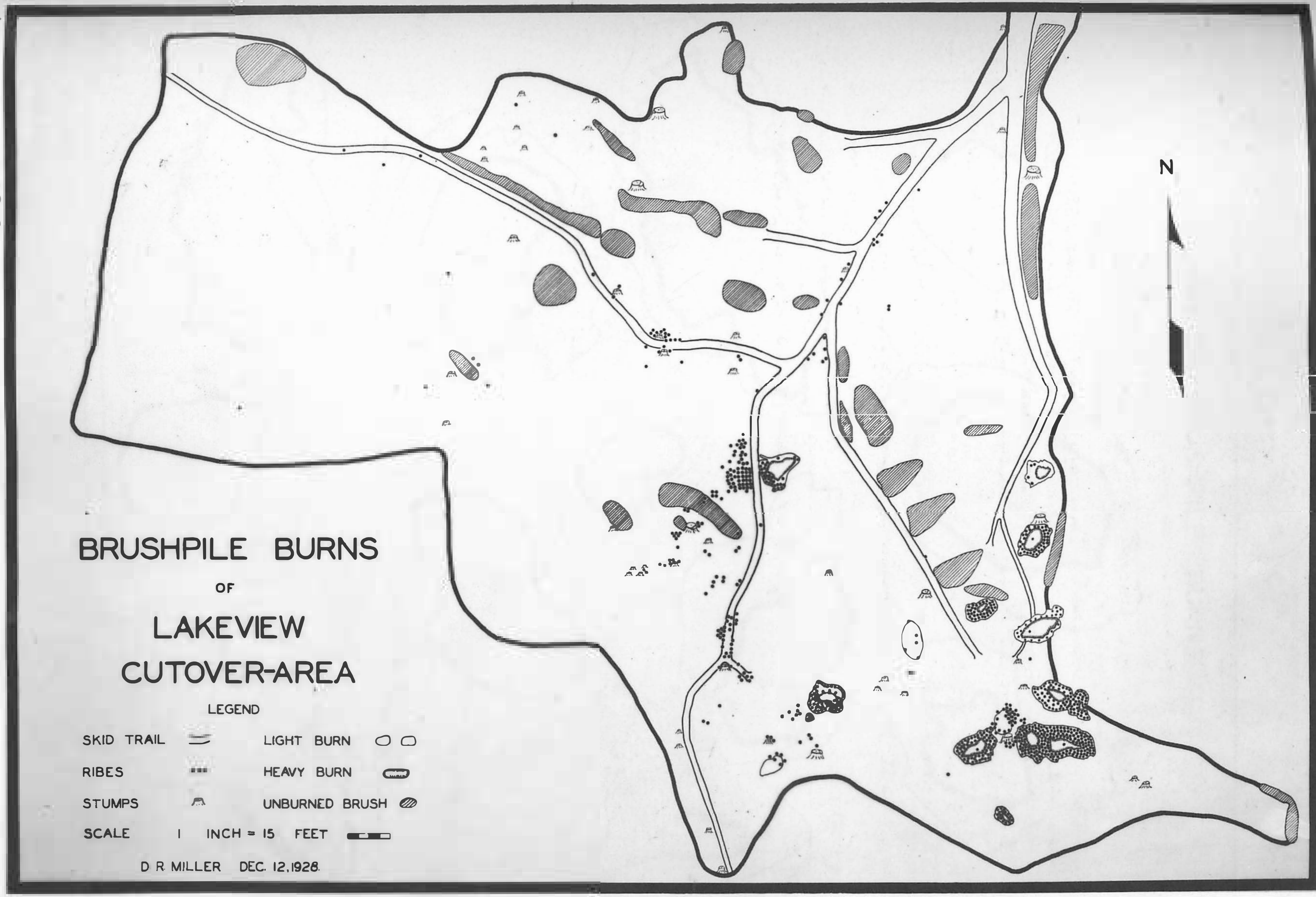
a. R. lacustre usually produces many seedling Ribes to restock the area.
b. R. petiolare usually produces many seedling Ribes to restock the area.
c. Reaction of G. inermis not yet known.

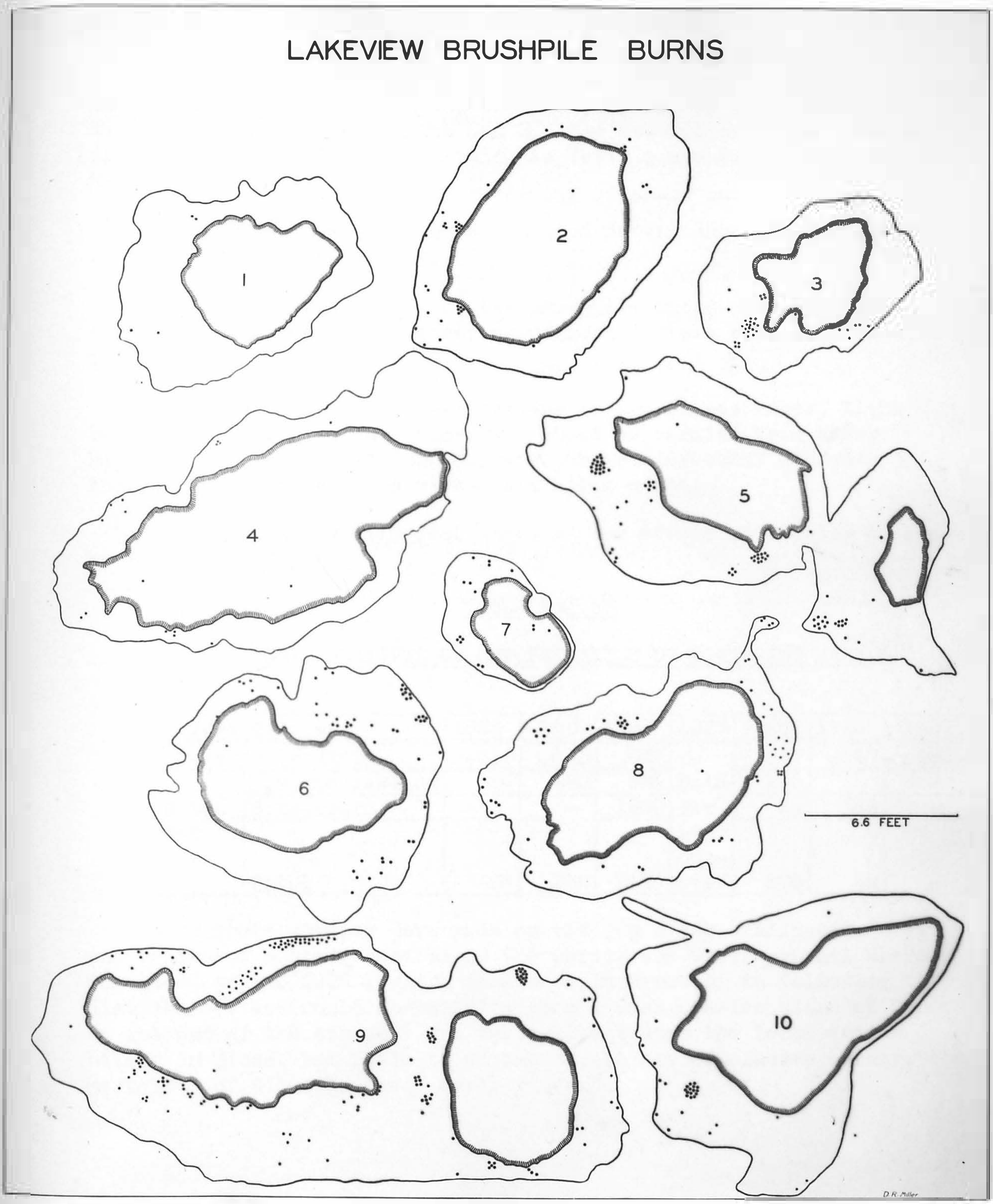
These tentative conclusions are stated only to present the trend of field data so far gathered, and later findings may modify these conclusions.

D. Logging Studies.

A detailed examination of a small cutting area near Lakeview, Idaho was selected for a study of the effects of logging. The area was covered by a mixed white pine stand of the 80-100 age class, from which the cedar, amounting to about 50 per cent of the stand, was logged. The results of this study are shown on maps No. 1 and 2.

Map No. 1


N
BRUSHPILE BURNS
OF
LAKEVIEW
CUTOVER-AREA
LEGEND
SKID TRAIL
LIGHT BURN
RIBES
HEAVY BURN
STUMPS
UNBURNED BRUSH
SCALE 1 INCH = 15 FEET
D R MILLER DEC. 12, 1928.



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Practically all of the Ribes are directly associated with the skidding and brush-burning operations on logged areas.

The Ribes within the outer limits of the brushpile burns are more or less distorted as to relative positions on Map No. 1 but are shown correctly on the accompanying map of the several individual brushpile burns, Map No. 2. The absence of Ribes from the unburned brushpiles is as striking as their presence is where the brush was burned.

This study will be re-examined during succeeding years for further data on the subject.

The detailed maps of the brushpile burns give evidence similar to the results of other experimental field work done under this project.

The study shows that burning brings in new Ribes, light burning resulting in many times the stand as results from heavy burning. The heavy burning, however, shows sufficient Ribes to thoroughly stock any area with a new Ribes stand.

A slightly different angle of the effect of logging is shown by Table No. 16.

TABLE NO. 16

RIBES SURVIVAL ON CUTOVER AREAS OF DIFFERENT AGES

Year Cutover		1928	1927	1926	1925	1924	1923	1922
No. Acres in Strip		.018	.008	.027	No	.047	.017	.028
Ribes Per Acre	R. viscosissimum	56	250	926	Data	106	-	-
	R. lacustre	-	-	1260	For	64	59	-
	Total	56	250	2186	1925 Cut-over	170	59	-

These studies were made on the Big Creek eradication area, and represent a cross-section of the conditions which prevail there. The Ribes on the 1928 logging area were just coming in following the disturbance, and would undoubtedly show a much heavier stand of Ribes at the end of the season. The table illustrates the local variability in Ribes, but fails to emphasize, in any conclusive manner, the mortality of Ribes in their early years.

A region of more uniform timber and Ribes conditions on which to initiate this study, is necessary to graphically portray the conditions on logging areas of different ages.

In summary, duff disturbance is very effective in starting a new stand of Ribes, whatever the means of disturbance.

The seeds of Ribes appear to be so universally distributed that generally a disturbance of the duff, in any part of northern Idaho, results in many Ribes.

C. Light-Moisture-Duff Study

I. Definition

Described in 1927 Annual Report on Page 195.

II. Methods

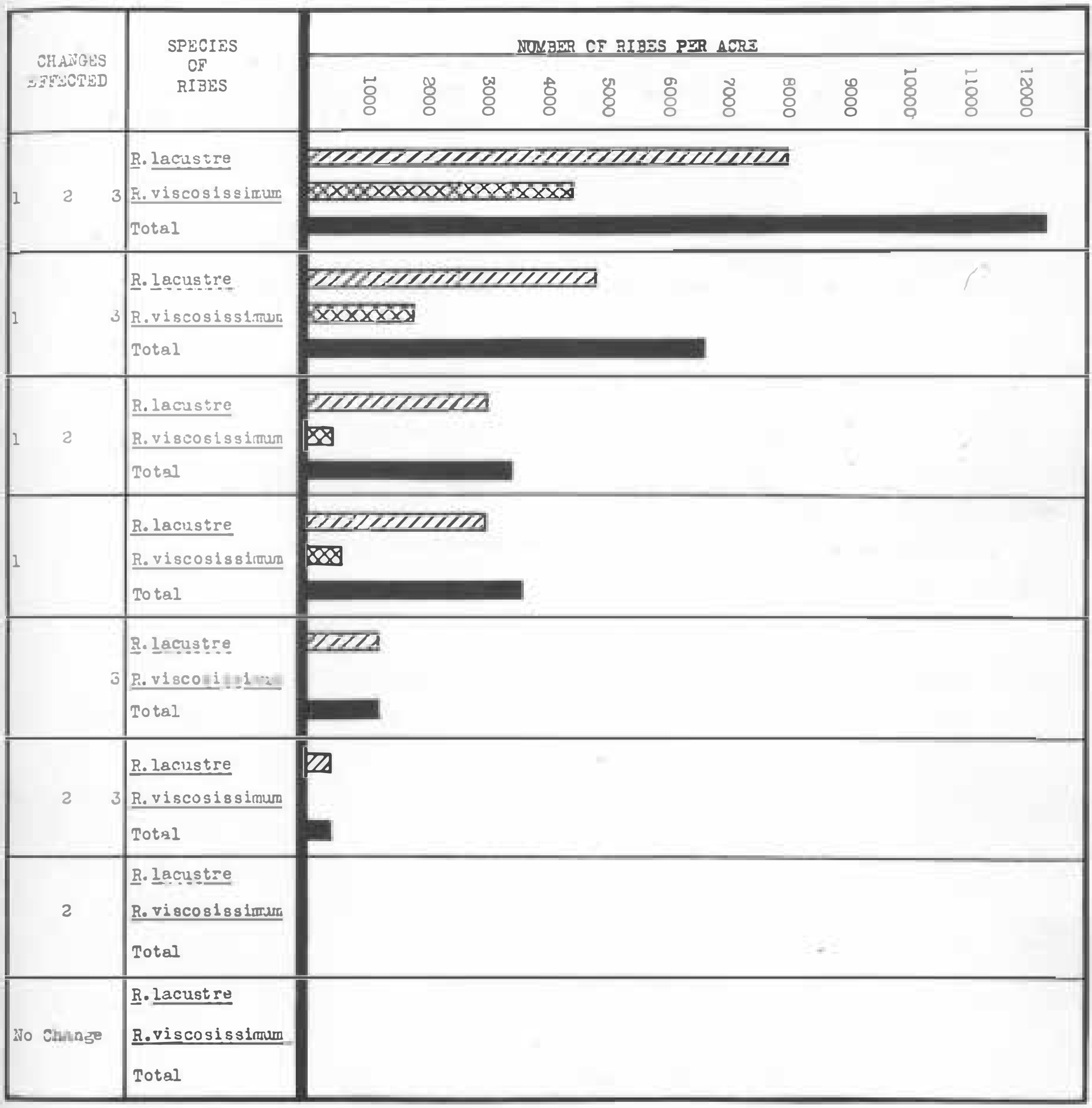
Described in 1927 Annual Report on Page 195, 196 and 197.

III. Results

This study is three-fold in its results.

The three-fold effects are best shown in Graph No. 1.

GRAPH NO. I
LIGHT - MOISTURE - DUFF STUDY



Legend (1. Removal of timber canopy to admit light.
(2. Trenching 24" deep to cut off all outside roots entering area.
(3. Loosening of duff with rake to admit light and air.

Annual Report 1928
W. A. Rockie

This graph shows that these three changes are not of equal importance and effect.

The effects of (1), the removal of the timber canopy, can be stated as follows:

a. New stand of R. visocissimum.
b. Multiplied number of R. lacustre.
c. Multiplied number of total Ribes.

The effects of (2), trenching to cut all roots which enter the area, can be stated as follows:

a. Alone, appears to be without effect.
b. When with (1) or (3), appears to be without effect.
c. When with (1) and (3), data indicate that it has some effect.

The effects of (3), loosening of duff, can be stated as follows:

a. Alone, appears to result in relatively thin stand of R. lacustre.
b. With (2), appears to result similarly.
c. With (1), or with (1) and (2), it appears to considerably increase the stand of Ribes.

These results alone should serve only as indicators, and not as conclusive proof, of the points under consideration.

Table No. 17 shows the results from the moisture study plots. These were described in Table 25 of the 1927 ecology report.

TABLE NO. 17

Name of Plot	No. Milacres		No. Ribes		Ribes Per Acre	
	Trenched	Not Trenched	Trenched Plot	Untrenched Plot	Trenched Plot	Untrenched Plot
Lakeview #1	1	1	-	-	-	-
" 2	1	1	-	-	-	-
" 3	1	1	-	-	-	-
" 4	1	1	-	-	-	-
Meadow Creek #1	3	3	2 R. visco.	-	667 R. vis.	-
" " 2	3	3	-	-	-	-
" " 3	1	1	1 R. lac.	-	1000 R. lac	-
" " 4	1	1	-	-	-	-
" " 5	1	1	-	-	-	-
" " 6	1	1	-	-	-	-
" " 7	1	1	1 R. lac.	-	1000 R. lac	-
" " 8	1	1	-	-	-	-
" " 9	1	1	-	-	-	-
" " 10	1	1	-	-	-	-
" " 11	1	1	-	-	-	-
" " 12	1	1	-	-	-	-
" " 13	1	1	-	-	-	-
Total	21	21	2 R. visco. 2 R. lac.	-	95 R. visco 95 R. lac.	-

Three of the four Ribes seedlings, which appeared in the plots of this study, are barely inside the wire which was stretched on the ground to mark the plot boundaries. Very possibly the three are resultant from a minor disturbance of the duff in stretching said wire. The results of these plots, therefore, are practically negative, since Ribes appeared in great numbers only a few feet distant following the other types of disturbance. Ribes seeds must be present on these plots in great numbers, but this type of preparation of the plots appears not favorable to the inception of new Ribes. This conclusion is further supported by the fact that, on the edges of the trenches dug around these plots numerous Ribes seedlings did appear adjoining several plots.

In summary, it appears that the removal of the timber canopy is the primary factor to induce the inception of a new Ribes stand, this removal permitting both of the common upland species. The effectiveness of this factor is believed greatest in young stands, where the duff mantle is thin, decreasing with the heavier duff in the older stands.

The disturbance of the duff, with no other disturbance, appears as of lesser importance than is the timber canopy, altho this factor alone does result in a new stand of Ribes.

The trenching to eliminate moisture seepage through roots of outside plants appears to play practically no part in the production of a new Ribes stand.

D. Life Habits of Ribes

I. Definition.

This study consists of the various observations of several individuals, pertaining to the life habits of Ribes. The various observations are gathered wherever observed. With the aid of many observations a more accurate knowledge of the life habits of Ribes will become available.

II. Methods.

Specific instructions were issued to all field men on the project to definitely record all observations of unusual conditions. Systematic studies of some particular points were made during the entire season.

The Phenology of Ribes is a distinct phase of this study.

A herbarium of the associated plant species is a part of this study.

III. Results.

The following observational records were obtained:

A. Study of Roots of Ribes Bushes

This study was chiefly confined to young Ribes bushes. In nearly every case, the plant has its roots far below the wilting coefficient line. There was evidence that the soil in immediate contact with the rootlets was much drier than elsewhere. In many cases the soil had formed a hard crust around the root.

Correlation of these root studies and the soil moisture investigations appears to explain the death of many of the seedlings, due to the dryness of the upper layer of soil. However, after a plant has survived one season, its roots have penetrated to a sufficient depth to obtain moisture during the dry summer period, and thereafter some other factor likely predominates in causing the death of Ribes.

One set of soil samples from near a decadent bush showed that the wilting coefficient was reached at a depth of 9 inches, but the root system extended to a depth of 18 to 24 inches. However, it may be that, since most of the roots are within a few inches of the surface, the dry condition of the upper soil causes a deficiency of available moisture. While in this weakened condition, the plant is more susceptible to disease. Dr. E. E. Hubert examined the roots and stems of such a decadent plant, finding only the ordinary gooseberry mildew.

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TABLE NO. 18

MEASUREMENTS OF RIBES VISCOSISSIMUM
JUNE 20, 1928

Mil-acre Plot No.	No. of Ribes	Year of Germ-ination	Average Height of Bush in Feet	Average Ft. L. S. Per Bush	Average Ft. D. S. Per Bush	Average Ft. N. G. Per Bush	Average No. of Fruits Per Bush	% of Plants Fruit-ing
1	19	1925	1.92	4.74	.14	2.05	-	
2	16	"	2.25	8.52	.44	3.28	.25	12
3	7	"	4.34	55.94	6.95	17.50	66.0	71
4	19	"	2.74	21.20	2.31	7.51	30.0	42
5	31	"	3.43	16.90	2.90	4.67	31.19	48
6	29	"	3.89	13.80	1.64	4.28	14.41	65
7	25	"	3.89	21.68	2.12	4.80	39.04	84
8	21	"	4.01	17.71	1.89	4.52	24.47	57
9	16	"	3.16	8.65	.68	3.03	2.06	12
10	15	"	2.79	9.06	1.17	2.52	8.73	33
Aver-age	198	"	3.28	15.82	1.79	4.69	20.59	43.4

On July 25 no Ribes fruits remained on the bushes described in Table No. 18 no fruits had disappeared from the caged Ribes bushes nearby. The green fruits had all been eaten before maturity.

The following study was made as a follow-up of the foregoing findings:

B. Chipmunk - Ribes Seed Study

It was known that chipmunks ate R. viscosissimum fruits, and it was thought advisable to learn if the seeds thus consumed had been destroyed by these rodents, or whether the seeds might still grow.

One of the caged R. viscosissimum bushes on Gold Hill near Harvard, Idaho (Bush #4) was selected. It had 109 ripe fruits on the bush at the time.

The top, bottom and sides of the cage were of galvanized window screen laced and nailed together so that it was rodent-proof. A white muslin cloth was fastened tightly over the screen floor, to facilitate collection. A pan of water was placed on the floor of the cage. A wooden box containing some lichen was also put in for shelter.

W.175. Taken in August 1926 showing vegetation of original forest floor, above string, and vegetation succeeding the May 1925 fire, below the string. The R. viscosissimum are 1926 seedlings. Meadow Creek Burn #1 near Harvard, Idaho.

W.705. The same as W.175 on June 20, 1928. The R. viscosissimum are 3 year old plants.

On the afternoon of August 24, the chipmunk was placed in the cage. On the morning of August 25, at 9 a.m. all of the 109 fruits were gone from the bush. The chipmunk's stomach was markedly distended, though the animal was in good spirits at this time. On August 26 (Sunday) no one went near the chipmunk. On August 27, one of the men kicked at the box, but no chipmunk appeared. On August 28, the cage was opened, and the chipmunk was found dead in his sheltering box. Its cuddled position indicated that it may have died from exposure (there had been a heavy frost on the preceding night). It could not have died of thirst, as water remained in the pan.

The body was found to be in good flesh on this date, and the stomach and intestines were packed with black excreta. The excreta in and nearest the stomach was liquid, becoming more solid as its position was farther removed from the stomach. All of the excreta was removed and preserved.

On September 2nd, everything on the muslin floor of the cage was examined. Some free R. viscosissimum seeds were lying on the muslin, as though they had dropped from the fruit as it was being torn open. All excreta and hulls of Ribes fruits were preserved for later examination.

On September 6, some of the excreta was examined under the lens. Numerous hulls of seeds were found, but no whole seeds. All material not examined at this time was saved for laboratory examination.

All remaining material was examined under the lens in the laboratory at Moscow in November, 1928, and no seeds were found.

This is but a single case and should not be given too much weight, but it indicates that Ribes seeds were not spread by this animal except as they fell from the fruit as it was being eaten.

Based upon our counts of Ribes seeds per fruit, this chipmunk ate about 6000 seeds overnight, and every seed eaten was destroyed, so far as later germination is concerned.

C. Ribes Phenology

Gathering of data on Ribes phenology is in progress, in order that our knowledge of the effects upon Ribes by the seasonal changes and variations, may be increased and made more specific.

These data are recorded on Form WF-BRC #51, which is shown below. Accurate knowledge will be obtained only after many observations extending over several years are at hand. These data are as yet insufficient to attempt any generalization.

WF-BRC-#51-5/1/28.

RIBES PHENOLOGY

Year of Record	Observed		Name of Observer	Alt. in Feet	Ribes Species	Date Buds Burst	Date of Blossoms	Date Earliest Fruits	Date of Defoliation	Shade Conditions 1. Open 2. Part Shade 3. Shade
	Date	Place								

D. Herbarium

As an integral part of this study, a herbarium of the plants immediately associated with Ribes in northern Idaho has been started. The present list of recorded plant associates is larger than the actual collection of plants to date. The collection is being taken incidental to the other field tasks, and has not been stressed. Its primary use will be to acquaint the temporary summer men, as well as to aid the permanent personnel, to quickly learn such of the associated plants as from time to time become necessary.

E. Ribes Seed Germination Study

I. Definition

To learn the fundamental factors that affect the germination of Ribes seeds, and to isolate and measure those factors.

II. Methods

A. Laboratory Tests

Laboratory germination tests have been cooperatively carried on by Dr. E. E. Hubert of the Idaho Forest Experiment Station and by this office.

These tests were made at room temperatures in the research laboratory upon seeds which had been subjected to different extremes of temperature and moisture.

B. Field Tests

Field germination tests were established and carried on near Pierce, Harvard and Nordman, Idaho.

These tests were made partly on the areas established for a previously described experiment (Controlled Plot Study of Ribes) and partly on special planting plots established for this purpose.

The Ribes fruits were uniformly planted just beneath the surface of the mineral soil regardless of the amount or character of the duff or ash mantle.

These fruits were planted on some plots soon after all burning or other preparations of the soil were completed.

On other plots, the fruits were planted about one year after the plots had been disturbed.

C. Effect of Soil Color on Seed Germination

The seed box was made of wood, 9 feet long, 2.5 feet wide and .75 feet deep. The box was divided into three compartments, and each compartment into six divisions for planting.

Each compartment was filled with uniform sandy loam soil. One compartment, when planted, was covered with sawdust $1\frac{1}{2}$" to 2" deep; the second compartment was left a mineral soil surface; and the third was covered with a thin layer of charcoal.

Half of each compartment was planted to 1928 fruits on August 25, 1928, and the surfacing applied over the planted areas. The other half of each compartment was planted to 1927 seed on September 8, 1928, and the surfacing applied to those areas at that time.

III. Results

A. Laboratory Tests

The results in Dr. Hubert's laboratory during the past year are entirely negative.

B. Field Tests

Left-W 21. This large R. sanguineum bush was photographed at the edge of the Cheekye Plot in May, 1924. On September 26, 1925, the area was burned over.

Below-W 707. The remains of this same bush are shown as they were photographed on May 10, 1928, showing some dead stems of the bush still standing. The bush was entirely killed by the fire.

The new generation of R. sanguineum, consisting of 74 1926 seedlings on May 10, 1928, is marked by white tags. (Each tag is directly behind a 1926 R. sanguineum seedling.)

The surrounding area was carefully searched for Ribes seedlings but no others were found nearby. The grouping of these seedlings and the absence of seedlings from adjoining ground indicates that horizontal distribution of Ribes seeds is not a major factor in the spread of this species.

TABLE NO. 19

FIELD GERMINATION OF PLANTED RIBES FRUITS IMMEDIATE PLANTING

Type of Disturbance to Ground	Total No. of Fruits Planted	Results from Planted Fruits	
		No. That Germinated	% That Germinated
Unburned			
a. Undisturbed Check Plot	208	2	.96
b. Top Duff Removed	188	15	7.98
c. All Duff Removed	116	14	12.07
Total on Unburned Plantings	512	31	6.05
Burned			
a. Light Burn	188	96	51.06
b. Medium Burn	48	33	68.75
c. Heavy Burn	168	80	47.62
Total on Burned Plantings	404	209	51.73
Grand Total	916	240	26.20

It will be noted that but 6.05% of the fruits planted on unburned ground showed any signs of germination, while 51.73% of those planted on burned ground showed viability.

Basing the estimate of the number of seeds planted, upon a careful count of two hundred dissected fruits (average of 57 seeds per fruit), Table No. 20 shows the percentage of individual seeds which germinated.

TABLE NO. 20

PERCENTAGE OF GERMINATION FROM FIELD PLANTINGS OF RIBES SEEDS

Type of Disturbance	Estimated No. of Seeds Planted	Results from Planted Seeds	
		No. That Germinated	% That Germinated
Unburned			
a. Undisturbed Check Plot	10,716	31	.29
b. Top Duff Removed	10,716	62	.58
c. All Duff Removed	6,612	19	.28
Total on Unburned Plantings	28,044	112	.40
Burned			
a. Light Burn	10,716	1,213	11.32
b. Medium Burn	2,736	551	20.14
c. Heavy Burn	9,576	530	5.53
Total on Burned Plantings	23,048	2,294	9.95
Grand Total	51,092	2,406	4.71

This table shows that but .40% of the seeds planted on unburned sites germinated, while 9.95% of the seeds on burned plots grew.

Based upon the two preceding tables it is found that on unburned soils, there were but 3.61 seedlings per viable fruit, while on the burned soils there were 10.98 seedlings per viable fruit. The results are given in Table No. 21.

TABLE NO. 21

VIABILITY OF RIBES SEEDS

Type of Disturbance	No. Seedling Plants Per Planted Fruit	No. Seedling Plants Per Germinated Fruit
Unburned		
a. Undisturbed Check Plot	.15	15.50
b. Top Duff Removed	.33	4.13
c. All Duff Removed	.16	1.36
Total Unburned Plantings	.22	3.61
Burned		
a. Light Burn	6.45	12.64
b. Medium Burn	11.48	16.70
c. Heavy Burn	3.15	6.63
Total on Burned Plantings	5.68	10.98
Grand Total	2.60	10.03

The foregoing data present the results when the fruits are planted immediately after the disturbance of the ground.

Table No. 22 shows the results of plantings made in August 1927 on ground disturbed by the 1926 fires.

TABLE NO. 22

FIELD GERMINATION OF PLANTED RIBES FRUITS

Type of Disturbance to Ground	Total No. of Fruits and Seeds Planted	Total No. Fruits had at Least 1 Seedling Germinate	% Fruits Germinated
Unburned a. Undisturbed Check Plot	16 Fruits & 160 Seeds	-	-
b. Top Duff Removed	16 Fruits & 320 Seeds	-	-
Total on Unburned Plantings	32 Fruits & 480 Seeds	-	-
Burned a. Light Burn	16 Fruits	-	-
b. Hot Burn	48 Fruits & 960 Seeds	-	-
Total on Burned Plantings	64 Fruits & 960 Seeds	-	-
Grand Total	96 Fruits & 1,440 Seeds	-	-

The results are in striking contrast to those on which planting was not delayed. These latter tests resulted in no germination.

This indicates that some factor which exists immediately after a disturbance of the soil is favorable to seed germination, and that this favorable condition has ceased to exist a year later. It also shows that a burned soil is more favorable to the inception of a new growth of Ribes than is an adjoining area that is disturbed by some other means.

F. Leaf-Area Live-Stem Studies

I. Definition.

Same as on Page 212, in the 1927 Annual Report.

II. Methods.

In past years, some of the leaf measurements have been made in the field while the leaves were green. Other leaves were measured after they were dried. A preliminary comparative measurement of leaves in both the turgid and the dried conditions, indicated that a marked shrinkage in leaf area rendered the two types of data entirely different, unless a correction factor were applied.

To secure a measurement of this factor, 75 leaves of each species, R. viscosissimum, R. lacustre and G. inermis were measured when gathered and later were measured in the dried state.

Twenty five leaves of each species were from an open site, 25 from part shade site and 25 from a shady site.

The results of this study is shown in Table No. 23.

TABLE NO. 23

AVERAGE PERCENTAGE OF LEAF SHRINKAGE IN DRYING

Species of Ribes	From Open Form Bush	From Part Shade Bush	From Shade Form Bush	From All Forms
R. viscosissimum	19.1	21.6	18.6	19.7
R. lacustre	23.2	20.9	20.7	21.7
G. inermis	19.4	27.7	29.4	26.1

The measurement of the leaves was done with the planimeter, and for these leaves gives an accurate measurement of the shrinkage in area.

The leaves in Table No. 24 were measured on the circle scale.

TABLE NO. 24

SHRINKAGE OF RIBES LEAVES

Bush No.	No. Leaves	Total Green Area. Sq. Inches	Total Dry Area. Sq. Inches	Shrinkage Sq. Inches	Per Cent Shrinkage
		Shrinkage of R. viscosissimum leaves			
1	60	125.57	97.52	28.05	22.34
2	96	236.16	183.98	52.18	22.1
3	36	83.11	61.38	21.37	25.71
4	60	250.8	209.98	40.82	16.28
5	60	203.76	171.02	32.74	16.07
6	36	121.09	101.11	19.98	16.5
7	132	247.09	202.56	44.53	18.02
8	48	160.63	135.1	25.55	15.91
9	60	221.11	187.38		15.25
10	36	128.31	110.89	17.42	13.58
11	72	204.09	177.56	26.53	13.0
12	160	461.33	395.22	66.11	14.33
13	96	268.41	226.86	41.55	15.48
14	96	227.43	198.72	28.71	12.62
15	36	158.83	130.4	28.43	17.89
16	42	270.86	229.06	41.8	15.43
Total	1,126	3,368.58	2,818.74	549.5	16.32
		Shrinkage of R. lacustre leaves			
1	160	341.79	291.45	50.34	14.73
2	160	217.41	178.75	38.66	17.78
3	57	173.64	147.75	25.89	14.91
4	120	245.77	221.35	24.42	9.94
5	160	463.69	399.70	63.99	13.8
Total	657	1,442.3	1,239.0	203.3	14.1

All of the measurements, whether by planimeter or by circular scale, indicate a marked shrinkage of leaf area. Shrinkage of R. viscosissimum and R. lacustre leaves, present data indicate, will approximate from 15 to 20 per cent while G. inermis leaves shrink from 20 to 30 per cent. This work was done outside of the range of R. petiolare, so no data have been obtained for this species.

Tentatively, therefore, dry measurements of R. viscosissimum and R. lacustre leaves will be increased by a 15 per cent factor, and those of G. inermis by a 20 per cent factor. These figures are empirically used and are conservative.

Table No. 25 represents the total Ribes leaf measurement work to date.

TABLE NO. 25

TOTAL MEASUREMENT OF RIBES LEAVES

Species	No. of Bushes Measured
R. lacustre	189
R. viscosissimum	193
G. inermis	33
R. petiolare	-
All Species	415

G. TEMPERATURE - MOISTURE INVESTIGATIONS

I. Definition.

To isolate and to measure the effects of the various site factors upon the germination and growth of the four common species of Ribes.

II. Methods.

A. Temperature Investigations. This is primarily a study of forest soil temperatures, as they pertain to the germination and growth of Ribes. Thermo-couples, supplemented by standard thermometers, and standard maximum and minimum thermometers, were used in making these studies.

The thermo-couple records at Harvard were read with a galvanometer, while those at the Priest River Experiment Station were recorded by means of a pyrometer. The data were recorded on Form WF-BRC #58.

The soil temperatures on the surface of the duff, in the duff, at the top of the mineral soil and at lower depths in the mineral soil were taken to learn the conditions under which the seeds and plants live.

These sets of temperatures were needed, (1) Under timber shade, (2) With timber shade removed and (3) With variously altered soil surfaces.

The diurnal temperature changes were also deemed necessary.

B. Soil Moisture Determinations. Determination of the soil moisture contents were made, (1) on Controlled Plot Study areas, (2) on certain contrasting forest sites and (3) on other areas the wilting coefficient for each of the four common Ribes species was measured.

The soil moisture determinations were made as follows:

All duff and vegetative ground cover were carefully removed from the point where samples were desired. A brass tube cylinder of exactly 10 square centimeters inside cross-sectional area and 10 centimeters long, was used. The lower edge was bevelled on the outer surface for cutting purposes. The cylinder was placed upright with the cutting edge on the exposed soil, and was then carefully driven into the soil until the soil section was more than flush with the top of the cylinder. A flat trowel was then placed beneath the cylinder, and the whole lifted. The excess soil projecting on either end was removed with a thin blade, the contents placed in an aluminum drying cup and hermetically sealed. The cup number was recorded on Form WF-BRC #59 so that its number is definitely entered opposite the field data.

These samples were usually secured on Friday and Saturday of each week, taken to the laboratory at the University of Idaho late on Saturday, weighed and then placed in the drying oven. Each sample was again weighed twice at intervals of two hours on the following Monday morning, and, in case the samples were not oven-dry, was left in the oven until the next week-end.

All soil moisture samples for all purposes were taken and cared for in the manner described.

The wilting coefficient of the various Ribes species, and of a few intimate plant associates, was obtained by the following procedure:

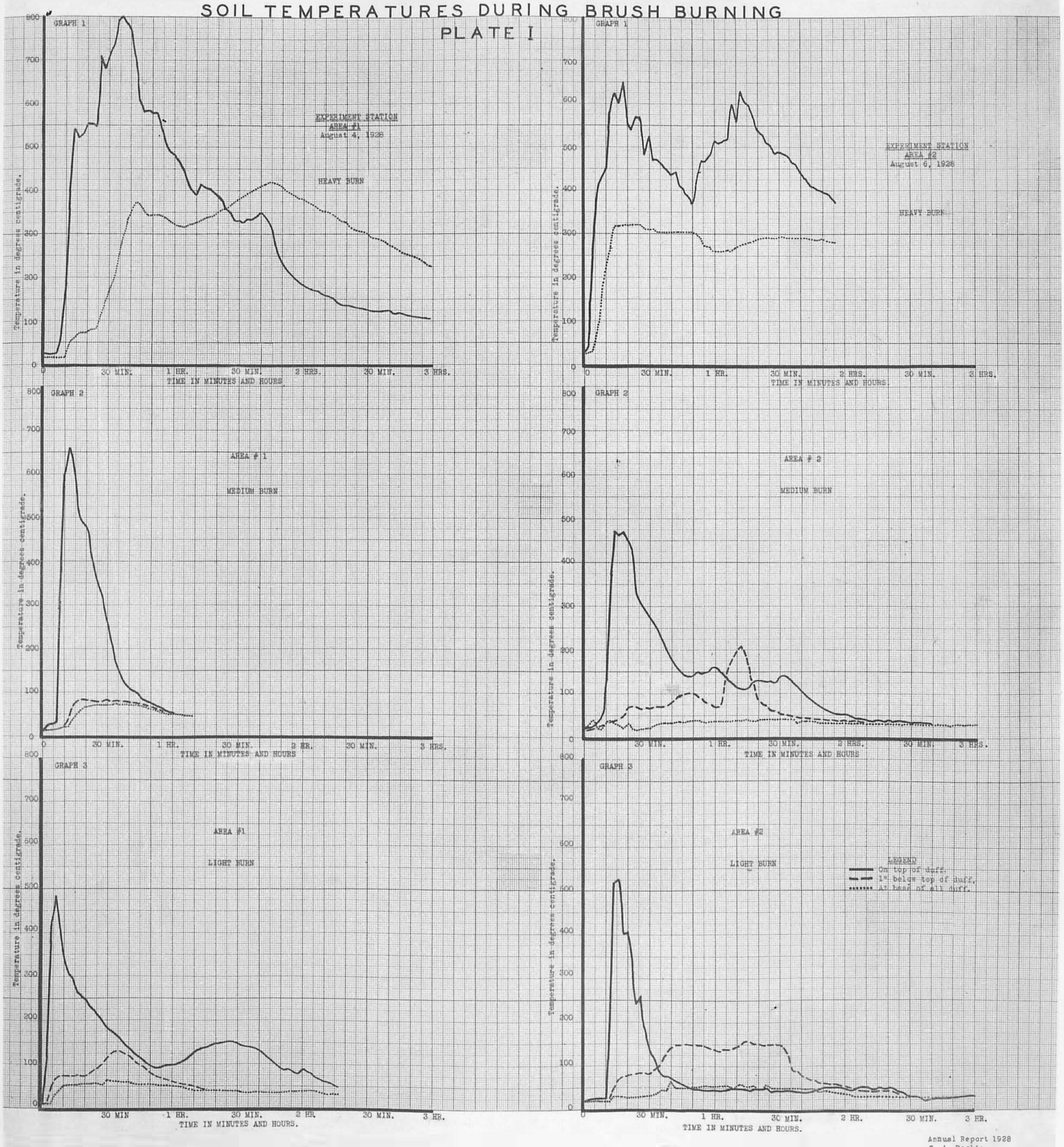
A ball of earth containing the undisturbed root system of the plant was dug loose. It was made large enough that practically no roots of the plant were exposed on the base or sides of this ball. Many plants were discarded after they were dug out because it was found that a large root had been severed.

This earthen ball was then placed in a suspended basket made of window screen. Over this suspended basket, a frame was erected to support a muslin tent-roof. This roof protected the plant from the direct sunlight. No plant was used which showed signs of wilting during the first two days in the basket.

The plant was closely watched for the first signs of wilting, at which time one or more soil samples were taken from that part of the earthen ball where the root hairs appeared most abundant and the moisture content was obtained by the usual procedure.

SOIL TEMPERATURES DURING BRUSH BURNING

PLATE I



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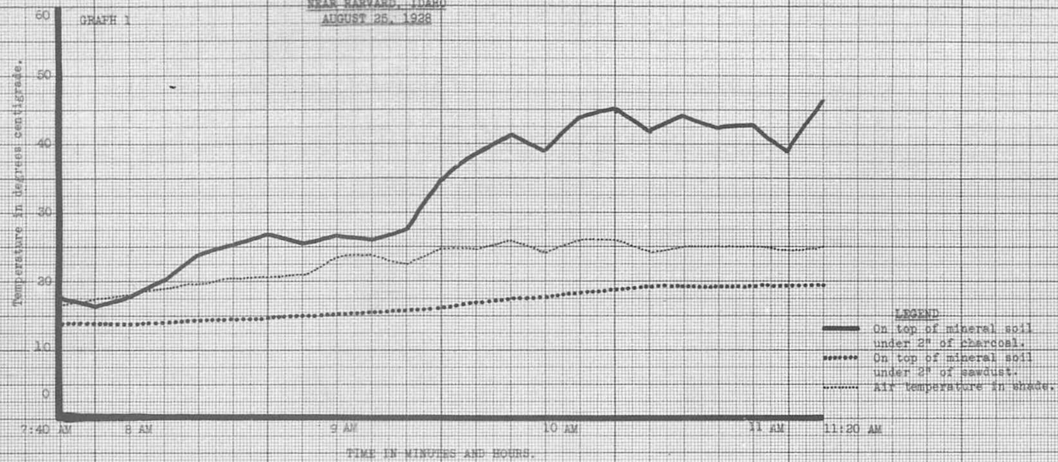
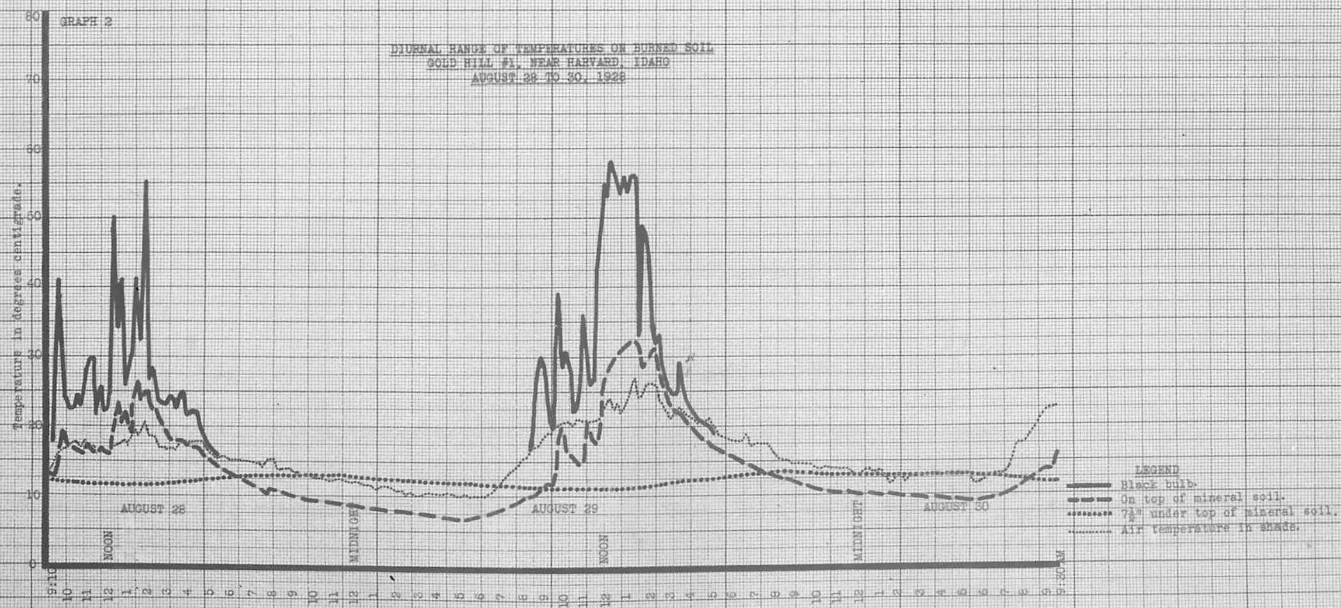
SOIL TEMPERATURE RECORDS

PLATE II

CHARCOAL VS. SAWDUST INSULATION AGAINST INSULATION.
GOLD HILL CONTROLLED PLOT STUDY #1.
NEAR HARVARD, IDAHO
AUGUST 25, 1928



DIURNAL RANGE OF TEMPERATURES ON BURNED SOIL
GOLD HILL #1, NEAR HARVARD, IDAHO
AUGUST 28 TO 30, 1928



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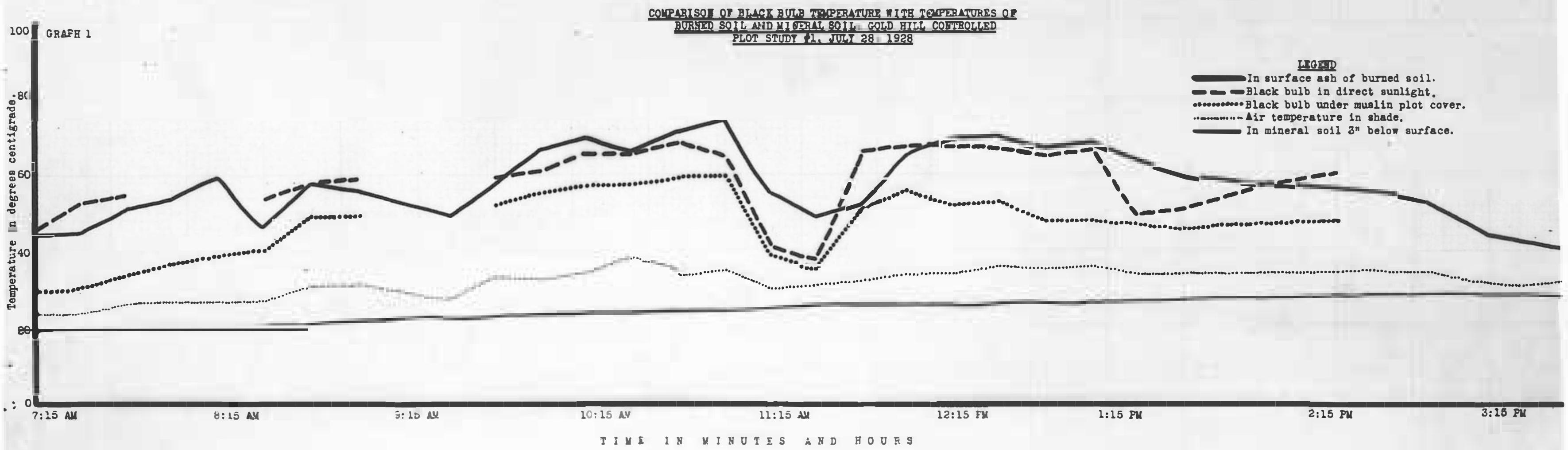
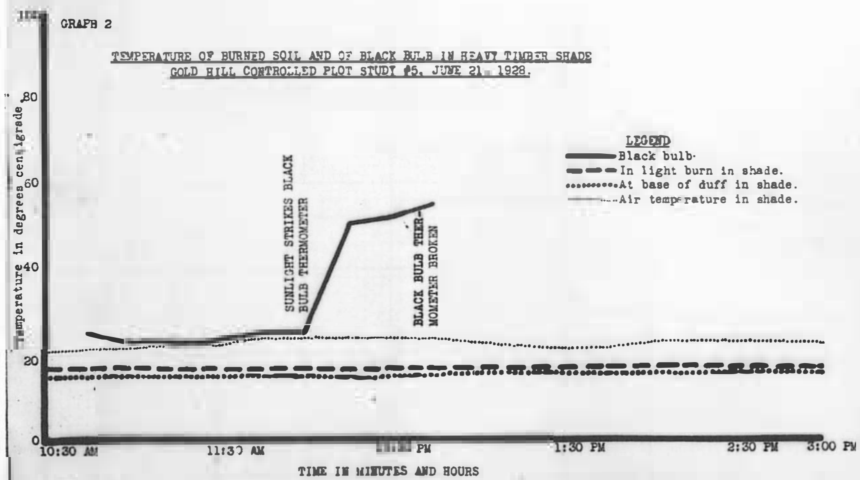
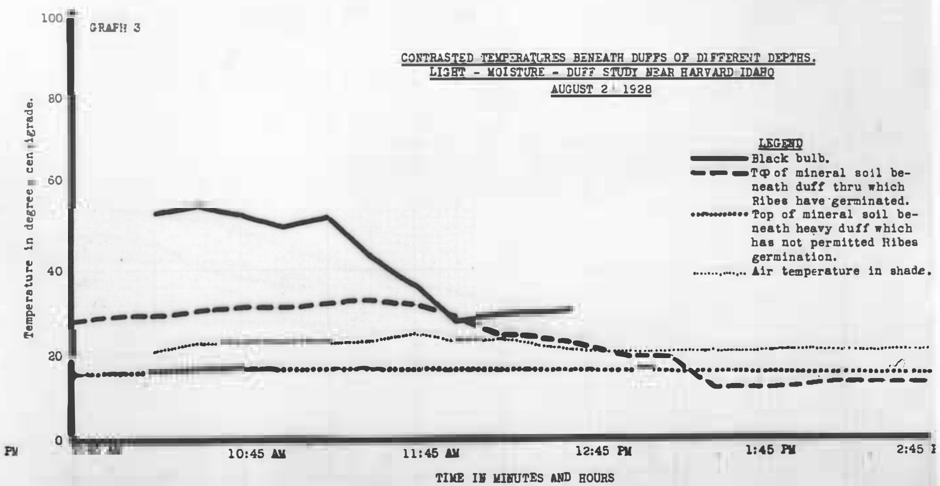
SOIL TEMPERATURES
PLATE III







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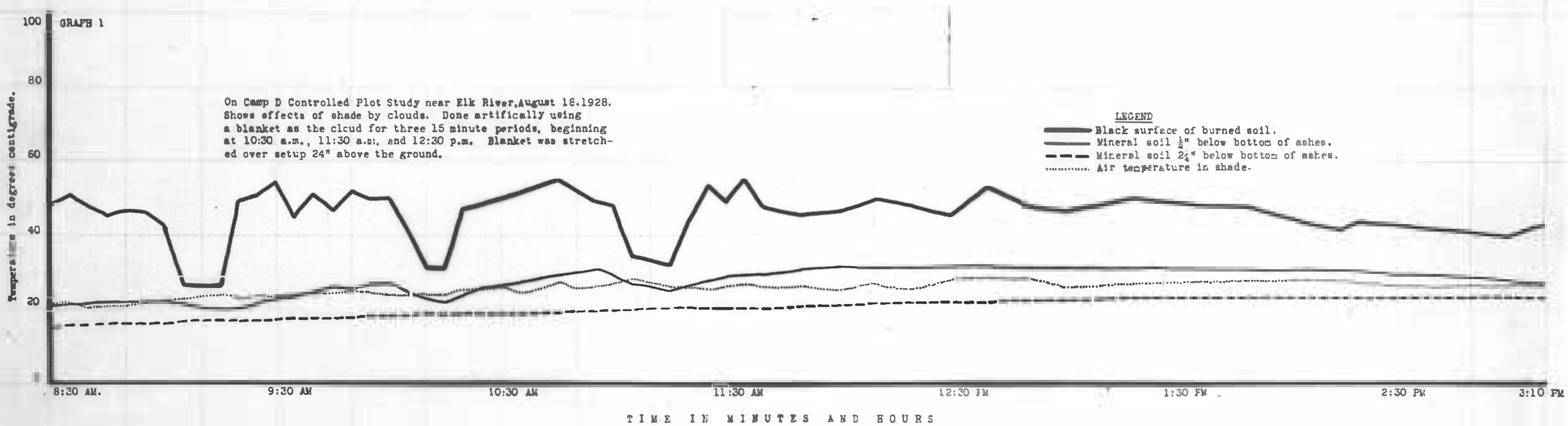
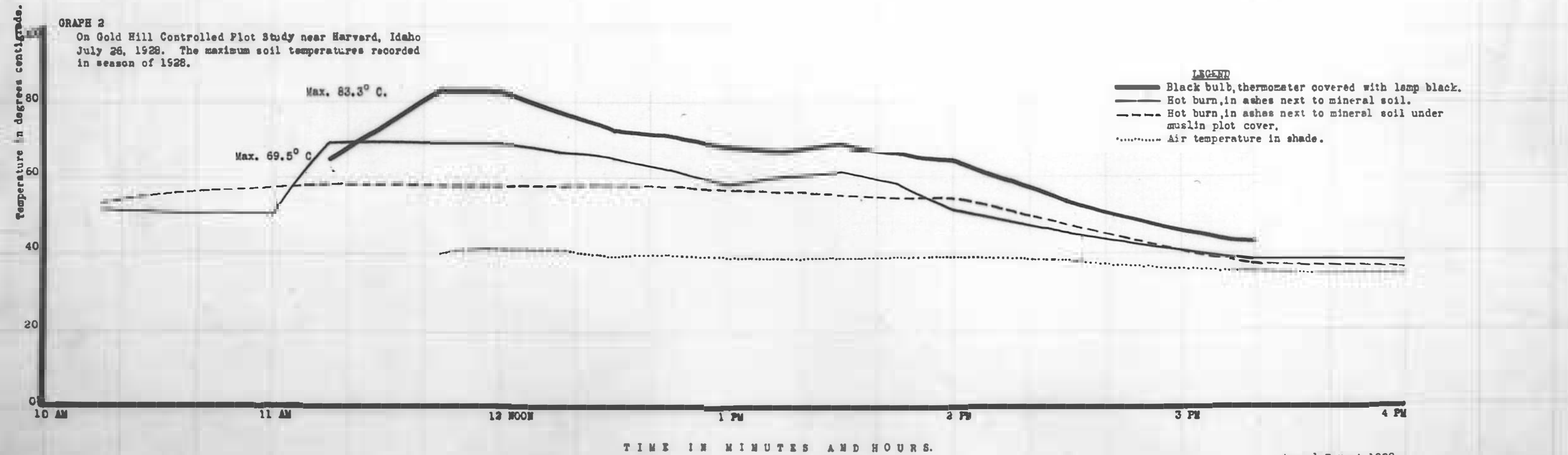
SOIL TEMPERATURES

PLATE IV





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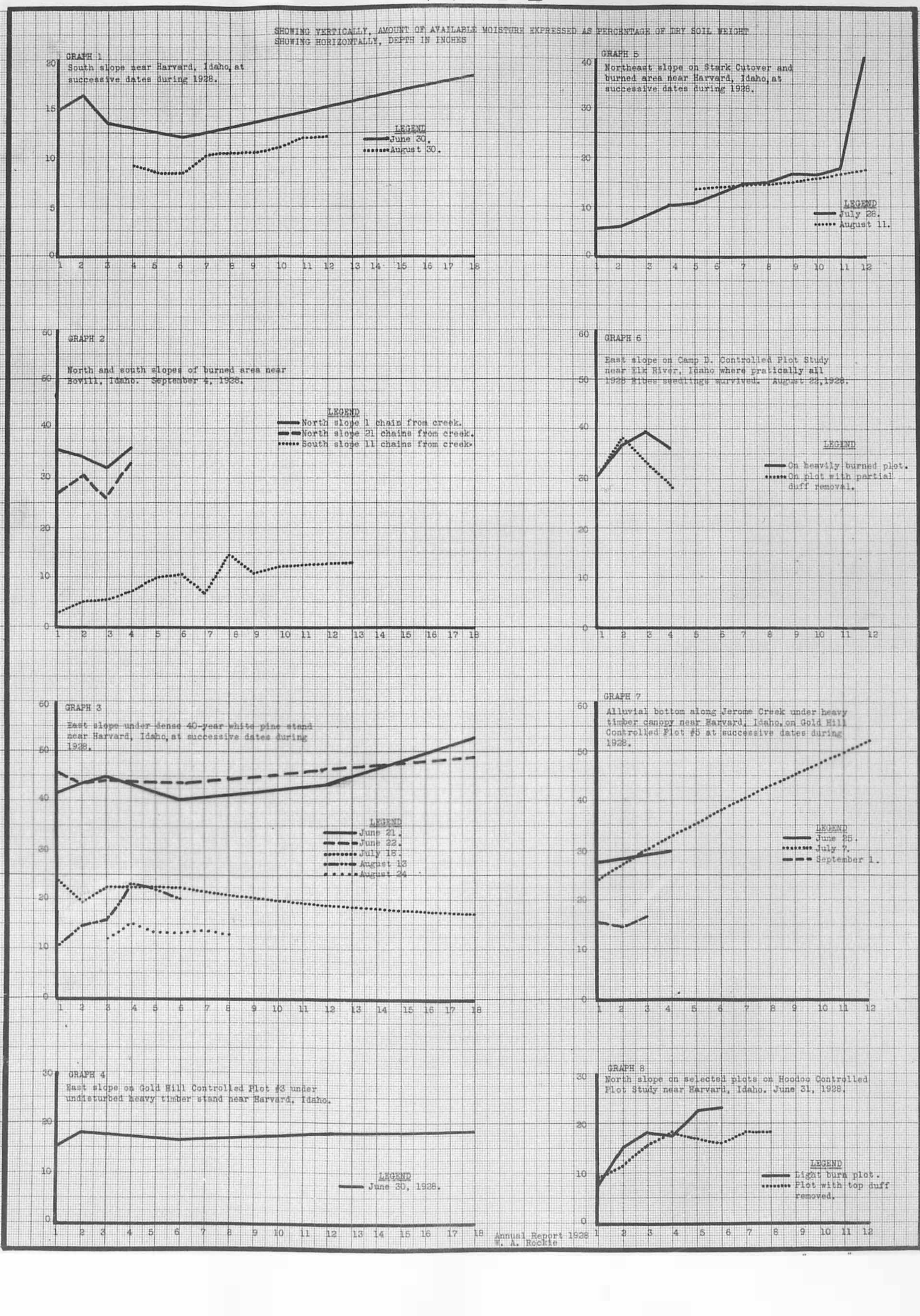
SOIL MOISTURE DETERMINATIONS
PLATE V



III. Results.

A. Temperature Investigations. The results of the various temperature investigations are summarized in Plates I to IV inclusive.

The temperatures reached at different points within and beneath the duff mantle during light, medium and heavy ground fires were obtained on two separate areas at the Priest River Experiment Station. These tests were made on the two Controlled Plot Study areas. The temperatures reached on the heavy burns closely approximate the actual conditions which occur in the burning of brush piles. All necessary technical apparatus was furnished by the Experiment Station. The results are shown by Plate I.

These graphs show that, on hot burns, the temperatures get sufficiently high to effectively destroy all viable seeds that are either in or immediately beneath the duff. On medium and light burns, the surface temperatures are usually sufficiently high to destroy the viability of any seeds there, but in the middle or basal duff, injury to stored seeds becomes rather problematical. The temperatures are rather variable, and in some instances will undoubtedly injure the contained seeds, while in other cases it will not. At the base of the duff, seeds will seldom suffer injury due to excessive temperature, since the highest temperature recorded there was about 70° C. on medium and light burns. This is considerably lower than insolation temperatures of the soil recorded in this same study.

Effects of insolation upon soil temperatures are very striking and show a very marked response to variable conditions. Graph No. 1, Plate II shows that a two-inch charcoal mantle causes the temperature at the base of that mantle to be 27° C. warmer than under a two inch mantle of sawdust. (Sawdust somewhat approximates duff as an insulator.)

Graph No. 2 of Plate No. II shows that in midsummer, (1) in the top charred soil there is a daily range of about 50° C., (2) at the top of the mineral soil beneath this charred surface, the range is about 25° C. and (3) at a point 7½" under the top of the mineral soil, the range is only about 2.5° C.

Plate III shows a number of contrasting temperature conditions. Graph No. 1 compares the actual temperature of charred ash with that of the black bulb, which is a sticky thermometer bulb dipped in lampblack

and laid on the duff surface. The black bulb is a good substitute for actual charred ash material, since the temperatures of the two conditions are very similar.

The same graph shows that the muslin plot cover reduces the surface soil temperature from 15° to 20° C. during the heat of the day.

Graph No. 2 shows that, under heavy timber canopy, the temperature of the charred surface soil is lower than the air temperature in the shade, except where the sun strikes a certain spot, in which case much higher temperatures result. But normally, the blackened soil shows very little rise in temperature during the day, while at the base of the duff the daily range is but 1° C.

Graph No. 3 shows that the temperature at the top of the mineral soil gets 16° C. warmer in the middle of the day beneath a one-inch duff mantle than beneath a two-inch duff mantle in the same situation.

Plate IV shows temperature records of various surface conditions on two Controlled Plot Study areas. Graph No. 1 shows the effect of clouds (artificially produced) upon the mineral soil at varying depths and under different conditions.

Graph No. 2 shows the maximum soil temperatures recorded during the past season. On July 26 with a maximum air temperature of 41.7° C. (107.1° F.) in the shade, the charred burn surface showed a maximum of 83.3° C. (181.96° F.) and the top of the mineral soil showed a maximum of 69.5° C. (157.1° F.).

B. Soil Moisture Determinations. The soil moisture conditions, at the time the Experiment Station burns were made, are given in Table No. 26. The moisture determinations were taken on the heavy burn areas and are indicative of the relative moisture conditions in the two areas. Area #1 is a steep north slope having a deep soil cover. Area #2 is on a very shady alluvial bottom along Benton Creek.

TABLE NO. 26

EXPERIMENT STATION CONTROLLED PLOT STUDY AREAS

Type of Material Sampled	Amt. of available moisture expressed as percentage of dry soil weight	
	Area #1	Area #2
Top Duff	53.1	25.7
All Duff	73.6	43.3
Fine twigs ($\frac{1}{4}$" and less)	21.6	21.2
Slash material	23.6	24.0
Upper 1" mineral soil	Not taken	11.1

W.468. R. viscosissimum plant near Harvard, Idaho suspended in basket to determine wilting coefficient of this plant species. This plant has not yet started to wilt.

W.462. R. lacustre plant near Harvard, Idaho suspended in basket to determine wilting coefficient of this plant species. This plant has just reached the wilting point.

The wilting coefficient was obtained for plants as shown in Table No. 27.

TABLE NO. 27

NUMBER OF PLANTS FOR WHICH WILTING COEFFICIENT WAS TAKEN

Plant Species	R. visco.	R. lac.	G. iner.	Rubus parviflorus	Spiraea lucida	Physocarpus pauciflorus
No. individual plants	20	5	7	4	4	2
Wilting Coefficient	11.9	17.95	11.4	12.5	8.26	8.95

The number of individual plants tested was not sufficient to be conclusive, but they are at least indicative of the amount of moisture needed to keep plants of that given species growing. The results are shown in Table No. 27.

A typical R. viscosissimum plant awaiting the wilting point is shown in Photo W468, while a typical R. lacustre plant which has just reached that point is shown in Photo W462. These photos are on Plate VI.

Plate V, Graphs No. 1 to 8, show the varying amounts of available soil moisture on different sites and slopes at successive dates during the summer season.

The temperature and moisture studies indicate that these two factors control the germination and growth of Ribes. Further studies, more specificially applied and controlled, should go far toward definitely answering many questions which still exist.

RIBES ERADICATION IN NORTH IDAHO

by

C. C. Strong

Assistant Forester

The activities of the Ribes eradication project in 1928 covered several fields of investigation. In addition there were five widely separated units engaged wholly or in part upon actual Ribes destruction in north Idaho. The combined annual report of the whole project is therefore made up of the various separate reports on each unit and on the special problems under study. Men who actually supervised the work of each unit in the field have written the reports in so far as this practice was possible.

Reports on eradication and pre-eradication work done in states other than Idaho are included elsewhere in the annual report.

The order of reports on work in north Idaho is as follows:

1. Project 3.02 - Experimental Application of Chemical Eradication of Wild Ribes in North Idaho.
2. Project 3.02 - Chemical Eradication Methods.
3. Project 3.22 - Experimental Ribes Eradication, Coeur d'Alene National Forest, Idaho.
4. Project 3.22 - Eradication Methods Report.
5. Project 3.22 - Checking Efficiency of Hand Pulling Methods of Eradication in North Idaho.
6. Project 3.22 - Re-eradication of Ribes in North Idaho.
7. Project 3.22 - Pre-eradication on Clearwater National Forest, Idaho.
8. Project 3.42 - Ribes Eradication on Private Lands, Idaho.

EXPERIMENTAL APPLICATION OF CHEMICAL ERADICATION OF WILD RIBES IN NORTH IDAHO

By

*C. C. Strong, Assistant Forester.

Introduction

The results of experimental application of chemicals for the destruction of wild Ribes during the period previous to the 1928 field season demonstrated conclusively that dense concentrations of such bushes can be destroyed cheaper by this method than by hand pulling. These experiments further demonstrated that continuance of the work should follow two general lines; namely, application of chemical spray by means of hand pumping knapsack equipment and the same by means of motor driven pressure equipment. Investigative effort had resulted in the discovery of suitable toxic chemicals and proven that a high degree of killing resulted from one application of such chemicals in the spray form to the leaves and stems of bushes during the growing season.

All responsibility for type of spray used by application crews was taken by the supervisor of the investigative work. Effectiveness of each formula used was previously established by thorough experiments running, in some cases, over a period of several years.

During the early part of the 1928 field season the field work of applying sprays on this large scale basis was supervised in a general way by the general supervisor of all chemical investigative work. However, there was a field supervisor whose duty it was to immediately supervise all the application work done by this project. Early in August it became advisable to place the general supervision of this phase of the chemical work under the general direction of the supervisor of Ribes eradication in the Inland Empire. Better coordination of all Ribes eradication activities was the reason for this change.

I. Purpose

In general the purposes for which field work was done were as follows:

1. To gain further information regarding the degree of practicability of chemical eradication of Ribes.

2. To determine whether hand operated or power driven equipment for applying chemicals was most practical or whether or not there was a field for both.

*Report written by C. C. Strong in absence of P. B. Bell.

3. To determine accurate costs of eradication by each method, or both, for varying conditions.

4. To determine the most practical field organization and crew unit for use with each method.

5. To train personnel for carrying on the work in the future.

II. Location and Description of Area

For this type of experimental work it was necessary to select an area where there were relatively heavy concentrations of Ribes extending over extensive areas along streams, otherwise classified as streamtype. Furthermore, it was desirable that most of these bushes be Ribes petiolare since that species was most easily killed by the chemical which had so far proven most effective as a toxic agent, sodium chlorate ($NaClO_3$). This chemical had not proven so effective when applied to Grossularia inermis. Another deciding factor was the fact that R. petiolare is far more dangerous than other species of wild Ribes in North Idaho in harboring and disseminating white pine blister rust. A large scale destruction of R. petiolare bushes would thus be an effective measure in controlling the rust locally once it became established elsewhere in the same general region.

In addition to the proposed wholesale destruction of R. petiolare plans were included for spraying small areas upon which G. inermis was the predominating Ribes species present. Consequently it was necessary that the area chosen should have sufficient G. inermis to carry out the experiment.

Preliminary surveys were made of several areas. The area finally chosen as representing conditions satisfactory for the experiment was the eastern half of T. 41 N. R. 1 E. of the Boise Principal Meridian. All but sections 1, 2 and 3 drained into the East Fork of Potlatch Creek. It centers about 6 miles E., N. E. of Bovill, Idaho and is accessible by truck road which traverses the south side along the East Fork of Potlatch Creek. Bovill is located on a branch line railroad.

There were sufficient trails to reach all parts of the area not accessible from the road.

Except for the three southermost sections of the area chosen, which sections had timber removed, the timber stand is principally mature and all classed as white pine type.

A belt of stream type varying in width but probably averaging a little more than two chains along the east Fork of Potlatch Creek represented the heaviest concentration of Ribes encountered. Here R. petiolare predominated and averaged about 10-15 per cent density, density being determined by per cent of ground completely covered by Ribes growth. It was on this stream that the power spraying equipment was largely used. Even here some of the area less populated with Ribes was sprayed by use of knapsack equipment. In general power equipment was used where Ribes were sufficiently dense to permit almost continuous spraying with very little time loss while nozzle men were moving from bush to bush.

The only other stream of any size on the half township was Rob's Creek. On Rob's Creek the stream type averaged about one and one-half chains in width. Density of Ribes growth would range approximately from three to ten per cent. R. petiolare predominated. All the spraying on Rob's Creek excepting a small portion bordering the stream for a short distance where it flows into the East Fork of Potlatch Creek was done by means of knapsack equipment.

There are many tributaries to the two main streams described but relatively few of them had sufficient concentrations of Ribes to make spraying practical. Ribes along most of these tributaries were largely removed by hand pulling methods. Usually Ribes were dense enough for several chains up most of these tributaries from the mouth to permit knapsack spraying and in one or two cases power spraying was possible. However, the bulk of such stream type was more practically done by hand pulling. On the small streams R. petiolare was usually surpassed in abundance by R. lacustre.

III. Methods, Equipment and Materials

A. Power Spraying.

1. Equipment. Spraying with motor driven equipment necessitates considerably more expenditures and overhead supervision than does spraying with knapsack equipment. In addition to mixing vats, measures, pails, tubs, boilers, etc., used at the filling or mixing station the following equipment was necessary for power spraying:

a. Two 1½-horse power, air cooled gasoline motors (similar to fire pumpers). These motors were equipped with small capacity water pumps through which the liquid was forced into hoses and out through the nozzles in the form of spray. In order to obtain a satisfactory spray at the nozzle at all times it was necessary to maintain a pressure of from 75# to 150# at the pump depending on distance the spraying was being forced and the number of nozzles being used.

b. One-half inch rubber air hose capable of withstanding the maximum pressure and the rough usage prevailing under severe brush conditions. This hose was used for main line through which spray liquid was pumped to the smaller laterals and finally through the nozzles.

c. One-quarter inch rubber air hose with qualifications mentioned above. This hose was used as moveable lateral line to permit nozzle men leeway for spraying over a relatively large area.

d. Suitable air couplings, manifolds (distributors), nozzles, tools, etc.

2. Methods employed. The motor was set up as near as possible to the center of the setting or block. It was necessary, of course, to make the set-up at a point where water was immediately available. Mixing was done by the pump operator or mechanic right at the motor.

In the early part of the season the method and crew organization shown in Plate 1 was used. Strips averaged about 35 to 50 feet in width. The mainline was dragged or laid through the middle of a strip. Each strip was about 600 feet long. One end of the main line was attached to the pump. The mainline was made up of 100-ft. lengths with a male air coupling on one end and a female air coupling on the other. With the insertion of a Siamese cutoff or Y at each coupling it was thus possible to cut off any part of the line momentarily without stopping the motor. Each nozzle man (there being usually 4 or 5 per crew) carried a one-fourth inch lateral of 125 or 225 feet lengths. These laterals were attached to a manifold or distributor which was in turn attached at one of the segments of the mainline.

Men began spraying at the far end of the strip. They worked abreast each covering from 7 to 12 feet approximately. Each man coiled his lateral at the beginning of spraying and laid the coil at the strip end near the center of his section. The coil was laid in such manner that it would uncoil readily. Nozzle men then began spraying, walking backwards through the brush and pulling out lateral as necessary to permit freedom of action. When the entire length of each lateral was used up the crew front would thus be abreast of another cutoff. The hose men immediately uncoupled the latterals and nozzle men coiled again by dragging in their own laterals. The hose was so constructed and fitted with couplings that it could be readily dragged through dense brush by one man. Tangling was largely eliminated by proper coiling. While laterals were being coiled the hose man attached another manifold at the desired point and attached laterals to the manifold. Then the nozzle men were ready to go again with a relatively short stop for coiling.

SYSTEMS OF STRIP SPRAYING BY POWER EQUIPMENT

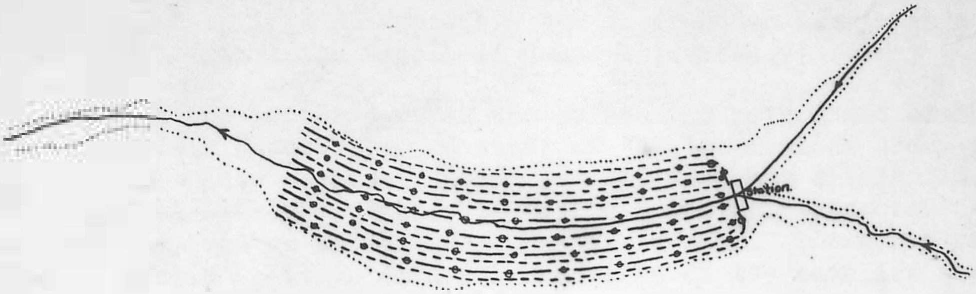


Plate No. I

Strip system first used in power spraying.

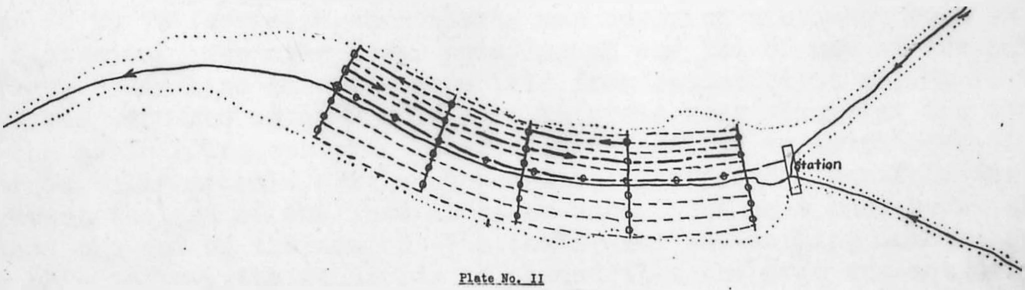


Plate No. II

Strip system used in latter part of season for power spraying.

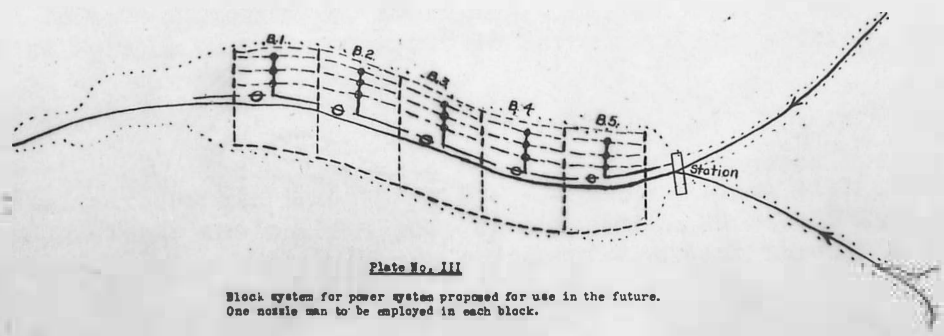


Plate No. III

Block system for power system proposed for use in the future.
One nozzle man to be employed in each block.

General Legend

Main line hose.
Laterals.
Strip boundary.
Type boundary.

As soon as the strip was completed it was necessary to stop spraying and move the mainline to the next strip. This necessitated considerable loss of time for motor and the entire crew.

The 225 foot laterals instead of 125 foot lengths eliminated so many breaks, couplings and coilings but their added length made them much more difficult to handle in dense thickets.

Toward the latter part of the season the method and organization shown in Plate 2 was used. A study of the two methods shown will readily show that much duplication and loss of time ~~were~~ eliminated in the second method over the first. In method 2 the mainlines was usually laid only twice, once up stream and once down stream. Therefore much lost time otherwise spent in successive movings of the mainline was eliminated. Furthermore the system made possible the laying out of several lengths more of mainline (up to a thousand or twelve hundred feet) thus greatly increasing the acreage worked from each setup. If the stream type was wider than could be worked as one strip the main-line laterals were attached at each 100 or 200 foot point on the main-line, depending on the lengths of laterals being used, to a Siamese or cutoff Y.

Strips were laid off as before except they were made wider, from 50 to 70 feet with each nozzle man spraying a segment from 12 to 18 feet wide. The crew began spraying at one end of one of the outer strips. Main line laterals were laid from and at right angles to the mainline with the outer end of such laterals kept always at the center of the strip being sprayed. Strips were parallel to mainlines, of course. All laterals were equipped with cutoffs and a manifold was always ready at the end of the lateral to be used. The hose man, especially toward the end of the season when the system was working more smoothly, was able to keep the manifolds so placed that the crew was not delayed from their spraying.

By the time the last strip on one side of the mainline was complete the hose man had at least one lateral moved across and laid to the outer strip on the opposite side of the mainline. Thus the spraying crew could begin spraying immediately on that strip.

In wide stream type, averaging 5 chains say, it was thus possible to spray a maximum of about 15 acres from one setting.

<u>B. Knapsack Spraying.</u>

1. <u>Equipment.</u> The D. B. Smith 5-gallon metal knapsack sprayer was used extensively for all hand spraying. It was equipped with shoulder straps and a single action hand pump of the same make as the tank. All liquid passed from an outlet in the bottom of the tank through a short

hose to the pump. By means of the pump, liquid was forced through a nozzle which was so constructed as to produce the desired spray mist. Usually spray passed through the nozzle at about 35-50 lbs. pressure.

All that was necessary in addition to the sprayers was the mixing equipment.

2. Methods. Early in the season the size of crew and the method of working varied considerably with the different areas. In general the method followed was to use from 3 to 6 men abreast on a strip previously marked off by string. Each man covered from 8 to 12 feet of the strip as his segment. Later in the season the output of work per man was greatly increased by reducing the number of men per crew. It was found that the larger the crew employed the more bunglesome and less efficient it was to handle. In fact the greatest output per man was secured by working men individually and alone on strips one rod wide. The slightly greater cost of laying strings for narrow strips was far offset by the increased area covered per man.

C. Hand Pulling.

No special equipment was used aside from the trench pick ordinarily used and the methods followed were the same as those described elsewhere in this general report on Ribes eradication in the Inland Empire.

D. Materials Used.

It is the business of the chemical application crews to use materials as killing agents which have previously been tried and proven by the investigative project. The following list of sprays prescribed shows the spray number and the formula:

Spray #1:	$NaClO_3$ 25%. 32# crystalline $NaClO_3$ to 12 gallons of water.
Spray #2:	$NaClO_3$ 25% with whale oil stock solution as a spreader on the leaf.
Spray #3:	$NaClO_3$ 25% and glue - obsolete.
Spray #4:	$NaClO_3$ 20%. 24# crystalline $NaClO_3$ to 12 gallons water.
Spray #5:	$NaClO_3$ 20% with whale oil soap solution.
Spray #6:	Mix 9.6# crystalline $NaClO_3$ with 7.2# flake $CaCl_2$ and add 9½ gallons more of water. Add one pint stock solution of whale oil soap and mix well.
Spray #7:	$NaClO_3$ 30% with whale oil soap solution.
Spray #8:	$NaClO_3$ 20# + 15# $CaCl_2$ + 10 gallons water + one-half pint stock solution whale oil soap.
Spray #X1:	27# $NaClO_3$ + 2.2# NaOH + 10 gallons water + whale oil soap solution.

Spray #X2: 25# $NaClO_3$ + 2# NaOH + 12 gals. water + whale oil soap.
Spray #X3: 11# $NaClO_3$ + 2# NaOH + 12 gals. water + whale oil soap.
Spray #X4: 11# $NaClO_3$ + 12 gallons water + whale oil soap.
Spray #X5: 11# $NaClO_3$ + 130 c.c. HCL + 12 gallons water + whale oil soap solution.
Stock solution whale oil soap: 1# whale oil soap dissolved in 4 gallons water.

E. Experimental Methods:

This will be the topic for a separate report by the Supervisor of Method Project.

IV. Worked Performed and Results

The following table is a complete record of all spraying done on the Bovill area during the field season with the area sprayed by the experimental crews near the end of the season excepted:

TABLE NO. 1

RESULTS OF SPRAYING WORK

Spray Number	Power Spraying		Knapsack Spraying		Total	
	Gals. Spray Used	Acres Sprayed	Gals. Spray Used	Acres Sprayed	Gallons Spray Used	Acres Sprayed
2	342	2.88	2,661	51.87	3,003	54.75
4	978	3.66	1,271	14.98	2,249	18.65
5	2,329	11.05	3,282	66.59	5,611	77.64
6	1,580	13.28	844	14.89	2,424	28.17
7	2,059	15.63	2,027	21.19	4,086	36.82
8	632	3.53	490	4.06	1,122	7.59
X1			61	1.50	61	1.50
X2	83	1.65			83	1.65
X3	65	1.40			65	1.40
X4	83	1.40			83	1.40
X5	122	1.20			122	1.20
Total	8,273	55.68	10,636	175.08	18,909	230.77

421.7 man days power spraying and 708 man days knapsack spraying.

TABLE NO. 2

RESULTS OF HAND PULLING

Man Days			No. Ribes Bushes Pulled					Acre-Age	No. Ribes Per Acre	Cost Per Acre
Laborer	Foreman	Total	R. lac.	R. visco.	G. iner.	R. pet.	Total			
294.9	100.3	395.2	88,737	3,660	1,056	21583	105,036	306.6	343	$7.51

The following table shows the cost of each item and the percentage of the total cost represented by that item for the three classes of work done at Bovill in 1928:

TABLE NO. 3

COST STATEMENT

Item	Hand Pulling		Power Spraying		Knapsack Spraying		Total	
	Cost	Percentage of Total Cost	Cost	Percentage of Total Cost	Cost	Percentage of Total Cost	Cost	Percentage of Total Cost
Salaries	$1400.00	60.8	$2058.94	38.2	$3088.40	39.5	$6547.34	42.15
Subsistence	630.50	27.4	1041.68	19.3	1562.52	20.0	3234.70	20.82
Transp. of men	90.00	3.9	130.54	2.4	195.82	2.5	416.36	2.68
" of equip	25.00	1.1	36.40	0.7	54.60	0.7	116.00	0.75
" of chem.			483.32	9.0	820.00	10.5	1303.32	8.39
Equipment	100.00	4.3	256.69	4.7	384.00	4.9	740.69	4.77
Misc. supplies	20.00	0.9	34.62	0.6	52.00	0.7	106.62	0.69
Twine	31.25	1.4	37.90	0.7	56.85	0.7	126.00	0.81
Motors (Oper. (Repr. (Depr.			384.83	7.0			384.83	2.48
Chemicals			937.83	17.3	1596.84	20.4	2534.67	16.33
Misc. expen.	5.00	0.2	6.00	0.1	8.99	0.1	19.99	0.13
Total	$2301.75	100.0	$5408.75	100.0	$7820.02	100.0	$15530.52	100.00

This table is inserted because it permits a ready understanding of the relative importance of each cost item in conducting this type of work.

The following table gives, in brief form, data on the amount and cost per acre of each type of work done:

TABLE NO. 4

COST PER ACRE BY EACH METHOD

Method	Total Cost	Acreage	Cost Per Acre
Hand pulling	$ 2,301.75	306.60	$7.51
Power spraying	5,408.75	55.68	97.14
Knapsack spraying	7,820.02	175.08	44.67
Total	$15,530.52	537.36	$28.90

VI. Discussion and Analysis

A great variation in average cost per acre exists between hand pulling, knapsack and power spraying. This variation is accounted for largely by the varying densities of Ribes growth where various methods of working were followed. Ribes bushes averaged 343 per acre where hand pulling was done. On the areas sprayed it was impractical (impossible in many cases) to attempt to count bushes. R. petiolare and G. inermis, where they are numerous enough for spraying, form a tangled mass where it is possible to describe volume of Ribes growth only in terms of per cent of ground covered. Hand pulling is seldom practical where Ribes density averages more than 1% of ground covered over extensive areas. On the other hand areas adapted to spraying range from about 1% to 35% Ribes density over extensive areas.

On the face of data presented it would seem that protective costs, on these areas of dense Ribes growth on streams, are excessive. That assumption would be true if chemical work could not be improved upon. However, such work has only begun and it is conservatively predicted that costs by both knapsack and power methods would be cut to one-half the present costs.

Had the entire job for the season been done at a rate comparable with the best work done near the close of the season and a ten per cent solution of spray used the cost of the job would not have exceeded the figures shown below:

TABLE NO. 5

Method	Total Cost	Acreage	Cost Per Acre
Hand pulling	$ 2,301.75	306.60	$ 7.51
Power spraying	2,784.00	55.68	50.00
Knapsack spraying	4,377.00	175.08	25.00
Total	$ 9,462.75	537.36	$17.59

It must be remembered that this large scale application of chemicals in 1928 was a first attempt and a decidedly pioneering venture. No similar work was known to have been done which would yield constructive information. Methods were only partially developed on a small scale previous to 1928. New and better methods had to be developed. Men had to be trained as leaders. All this could be done most effectively with a minimum crew the size of the one used.

Naturally work at the beginning of the season was much less effective than that done near the close. This phase of the progress will be discussed fully under the report on experimental chemical methods work.

One of the items representing heavy expenditures is that of the cost of chemicals and transportation of the same. Sodium chlorate ($NaClO_3$) is the most effective on R. petiolare. It is an expensive material. The sprays so far used have averaged nearly 25% chemical. It is now known that a 10% solution will be equally as effective if properly applied. This item alone will result in greatly decreased cost.

The combined work done by hand pullers and sprayers resulted in a relatively high degree of protection to 10,000 acres of white pine timber or reproduction. With the total cost of the job at $15,530.52 the average protection cost per acre for the first time over is $1.55. Since this particular half township was probably one of the heaviest jobs to be done, it is not at all impossible that the average protective cost per acre over the Inland Empire white pine belt will be about $1.00 for covering stream type the first time.

Considerable importance hinges on the relative effectiveness and practicability of spraying with the knapsack and power equipment. There are certain advantages and disadvantages to each method.

Knapsack spraying involves much less overhead expense than does power spraying. Use of motors involves a mechanic, one man per spraying crew to move hose, fittings, motors, etc. Then there is operation, repairs and depreciation on motors as well as various other incidental expenses not necessary to knapsack work. In addition power work involves much closer and more experienced supervision. This all means that a nozzle man on a power unit must spray a much larger volume of bushes per day than a knapsack sprayer in order to do the work at the same cost per acre.

The knapsack sprayer is handicapped some by having to carry his tank and spray solution. Although work on either unit is far from pleasant most men naturally prefer the power unit.

In general the results of the 1928 experiment favor knapsack spraying over power spraying from every standpoint, especially the economic. The basis for this conclusion will be found in the report on chemical experimental work previously referred to. However, further and more extensive experiments along the same line must be conducted in 1929 because the rapid advancement in improvement with both methods indicates that perfection is far off now. Further experimentation may prove that power work is more economical and more effective on areas of dense Ribes. There is little chance, however, that power spraying will ever surpass knapsack spraying on areas of less dense Ribes growth.

VII. Hazards Involved With Spraying by Chemicals

Use of chemicals which are toxic to Ribes growth result in a problem not faced by hand pullers. That is the problem of possible injury to men and equipment through inflammability and corrosive effect of some chemicals used. While sodium chlorate has little effect on equipment when such equipment is properly cared for it is dangerous to men after the solution is allowed to dry and previously sprayed or saturated materials subjected to friction. It is extremely important that men, use the utmost care when working with chemicals. Clothing must be kept damp and should be washed thoroughly at frequent intervals.

Some chemicals react noticeably on metals. Equipment must be made of metals little affected by the chemical to be used. All equipment must be thoroughly cleaned after each day's work if there is any likelihood of corrosion.

Various devices and substances have been used to lessen the danger to those in close contact with chemicals. None of these have so far proven wholly practical. So long as extreme care is exercised

there is little danger of serious injury. Clothing kept slightly damp makes the danger negligible and it is hoped that those inclined to be careless can be so impressed with the dangers resulting from carelessness that possible injuries will be averted.

VIII. Recommendations for Future Work.

After a thorough analysis of the practical and experimental results at Bovill, observation of units at work in the field over a long period, and accumulation of considerable knowledge regarding the performance of various types of equipment it now seems best that practical and experimental chemical eradication of Ribes in the near future be planned with the following aims in view:

1. Use of knapsack spraying equipment in the near future for practical spraying jobs. Power equipment may be later developed to the point where it will be practical on areas of more or less dense Ribes growth.

2. Further extensive experiments with power versus knapsack spraying equipment.

3. Further extensive experiments with knapsack spraying versus hand pulling on stream type areas where Ribes bushes occur singly with varying numbers per acre.

4. Development of more efficient and more satisfactory knapsack spraying equipment.

5. Development of motors for immediate use on experimental spraying units ~~with~~ which are more dependable under field use.

6. General development of the chemical methods work with the aim toward more practical methods of applying chemicals by both knapsack and power systems.

CHEMICAL ERADICATION METHODS

by
Herman E. Swanson, Agent

Introduction

This being the first season for any large scale chemical eradication, the problem of developing a practical and efficient method of operation was one for the entire chemical eradication unit. Early experiments, therefore, were concerned with the comparison in stream type of costs and efficiency between hand and chemical eradication. Even though the costs of chemical eradication were lower than hand pulling, the costs were excessive and it became necessary to make an intensive study in the method of crew work in the chemical unit.

I. Purpose

The purpose of this project is to develop a method by which the chemical eradication of wild currants and gooseberries, with such chemicals as provided, can be performed at a minimum of cost and a maximum of efficiency.

II. Location

All experiments and studies were performed on the areas at Haugan, Montana and Bovill, Idaho where the chemical eradication work was being carried on. During the last four weeks of the field season, all efforts were concentrated at Bovill, Idaho.

III. Cost of Project

	Bovill, Idaho	Haugan, Mont.
Salaries	$ 1,567.50	$ 250.00
Subsistence	504.60	45.00
Transportation of Men	175.00	60.00
Equipment	444.54	138.00
Chemicals	285.00	8.00
	$2,976.64	$501.00

IV. Organization of the Work

1. The first experiments were merely a comparison between hand and chemical eradication in various densities of Ribes concentrations. Methods for chemical eradication developed in 1927 were used.

2. Trial of combination methods, with crews made up of hand pullers and hand sprayers.

3. Perfection of knapsack and power methods of chemical eradication.

4. Final comparison in various densities of Ribes concentrations of the three units of eradication - hand pulling, knapsack spraying, and power spraying, using the best developed methods in each unit.

In getting these comparisons, the same areas in most cases were sprayed by each method, using water in place of chemical on the first spraying.

V. Results

A. Comparative Cost of the Various Methods Employed in Chemical Eradication

1. Knapsack

TABLE NO. 1

KNAPSACK METHOD

Ribes Concentration	Crew Method			Combination Method			Individual Block		
	Man Hours per Acre	Gals. Chem. per Acre	Cost per Acre	Man Hours per Acre	Gals. Chem. per Acre	Cost per Acre	Man Hours per Acre	Gals. Chem. per Acre	Cost per Acre
1%	7	34	$10.38				2	8	$ 2.76
1-5%	18	49	22.08	23	58	$27.66	3	11	4.02
5-15%	20	100	30.00	31	93	39.06	7		10.50
15-25%				58	113	65.76	10	75	18.00
100%							50	359	88.08

Cost basis:

$.75 per man hour	- hand pulling
$.90 per man hour	- chemical eradication
$.12 per gallon chemical	- (20% solution)

1. Crew Method - Three to five men with knapsacks working in a crew. This method was used during the greater part of the season.

2. Combination Method - Crews composed of two or three men with knapsacks taking the Ribes concentrations, accompanied by one or two hand pullers taking scattered bushes. Another method used was having one hand puller (Ribes hound) find the bushes for two or three knapsacks.

3. Individual Block - Each man with a knapsack assigned to an entire section of the stream, consisting of four to ten strips, 1/4 chain in width, laid out with string line, and one man laying string and tending

to filling stations for three or four men, or two men taking care of six or seven men in the same manner. This method succeeded in eliminating about all the lost motion occasioned by crew work and replacing it with an individual responsibility and a competitive feature conducive to faster and better work.

2. Power

TABLE NO. 2.

POWER METHOD

Ribes Concentration	Crew Method No. 1			Crew Method No.2			Individual Block		
	Man Hours per Acre	Gals. Chem. per Acre	Cost per Acre	Man Hours per Acre	Gals. Chem. per Acre	Cost per Acre	Man Hours per Acre	Gals. Chem. per Acre	Cost per Acre
1%							3.4	11.4	$4.42
1-5%							4.0	15.0	5.40
5-15%	65	197	$ 82.14	16	81	$24.12			
15-25%				18	162	35.64			
25-35%	75	370	111.90						
100%				30	397	74.64			

Crew Method No. 1 - One crew of four or five men working from the motor. (Method used during the greater part of the season, described in Bovill report on Chemical Eradication). The principal defects in the method were: operating cost excessive for so small a unit, much duplication and lost motion. This method was improved by a new system of hose lines which eliminated much of the lost motion.

Crew Method No. 2 - Four crews of four or five men working from one motor. Crew taking much wider strip where necessary. (Two chains as a maximum width of crew strip. This method also described in Bovill Chemical Eradication report).

Individual Block - This method of operation was not developed until the close of the season, consequently time did not permit a trial in all Ribes concentrations. It is possible that this method may prove more practical than knapsacks in the heavier concentrations. This individual block system for the power unit consists of one mainline (½" hose) along the stream type with a motor set up every 2100 feet or 2200 feet. At every 100-foot or 200-foot section in the mainline there is a Y connection

with a cut-off on each outlet. Each man is provided with 300 feet of ¼" hose and is assigned to a section of stream type along the main line. On the completion of his section, he detaches his hose and moves up to the next section at the head of the crew. The Y couplings with the cut-offs permit each man to work independently of the rest of the crew. There is never an occasion to move the entire unit, nor to stop operations to make a move. Work is done perpendicular to the stream in case of wide stream type (2 chains and over) and parallel to the stream in case of narrow stream type. The size and depth of the stream affects the direction of work. The method is adapted to all irregularities in the stream type. Eight to twelve nozzle men work in one unit from one motor. Each man has the first strip of his section laid out for him. He works this strip, then detaches his nozzle, lays the string line for his next strip, then pulls in his hose and proceeds to work the strip which he has just laid.

B. Comparative Costs of the Three Units of Eradication with the Best Developed Method in Each Unit.

TABLE NO. 3

RESULTS OF WORK BY EACH METHOD

Ribes Concentration	Size of Experimental Area Worked by Each Method	Knapsack			Power			Hand Pulling	
		Man Hrs. per Acre	Gals. Chem. per Acre	Cost per Acre	Man Hrs. per Acre	Gals. Chem. per Acre	Cost per Acre	Man Hrs. per Acre	Cost per Acre
1%	6 acres-Knap. 6 acres-Power 7 acres-Hand	2	8	$ 2.76	3.4	11.4	$ 4.42	10	$ 7.50
1-5%	4 acres-Knap. 4 acres-Power 6 acres-Hand	3	11	4.02	4.0	15.0	5.40	17	12.75
5-15%	16 acres-Knap. 14 acres-Power 1 acre -Hand	7	35	10.50	16.0	81.0	24.12	133	99.75
15-25%	2 acres-Knap. 4 acres-Power	10	75	18.00	18.0	162.0	35.64		
25-35%	½ acre -Hand							243	182.25
100%	1 acre -Knap. 1 acre -Power	50	359	88.08	30.0	397.0	74.64		

1. Individual block system in power work thus far has only been tried in concentrations 1% and 1-5%. The method used in power by which the other costs were secured was the best developed method for crew work.

2. A 100% area was secured by spraying all the brush in a 100% brush density.

C. Ribes Efficiency on Experimental Plots - Hand-Pulled.

TABLE NO. 4

EFFICIENCY OF EXPERIMENTS

Location	Ribes Concentration	Size of Experimental Area in Acres	Ribes Missed Per Acre (Includes Resprouts, Sdlgs., etc.)											
			R. petiolare			R. lacustre			G. inermis			Total		
			No.	L.S.	Sdlg.	No.	L.S.	Sdlg.	No.	L.S.	Sdlg.	No.	L.S.	Sdlg.
Bovill	3%	1.0	32	246		52	220						466	
"	8%	3/10	66	170		103	206					169	376	
"	10%	1/7	217	756		35	91					252	847	
"	35%	1/8	608	3168		32	32					640	3200	
Haugan	1%	1.0				27	65		36	168		63	233	
"	5%	3/10							80	353		80	353	
"	15%	3/10	170	220	116	20	13		220	310	133	410	543	249
"		3/10	1043	1363	46	10	16		6	20	3	1059	1399	49

Other plots were set off to get a comparison between the efficiency of hand and chemical eradication, especially on G. inermis. Approximately 3 acres in various G. inermis concentrations were worked by hand, and more than 20 acres by chemical eradication in the same concentrations. The recheck for efficiency on these areas cannot be made until 1929, when resprouts and survivals have had an opportunity to appear. No extensive checking was made on areas worked by chemical this year on account of the difficulty in determining what bushes would survive. Such a check will be made in 1929.

D. Experiments with Equipment.

1. Tests made with pressure tank and hand tank. (¼ acre plot).
   Cost basis - Man hour = $.90   Gallon chemical = $.12

TABLE NO. 5

RESULTS OF EQUIPMENT EXPERIMENTS.

Equipment	Nozzle	10% Ribes Concentration			30% Ribes Concentration		
		Man Hrs. per Acre	Gals Chem. per Acre	Cost per Acre	Man Hrs. per Acre	Gals. Chem. per Acre	Cost per Acre
Pressure Tank	Special 1/100"	6.5	28	$ 9.21	13.6	72	$ 20.88
Pressure Tank	No. 111 Fine	3.4	32	6.90	7.9	90	17.91
Hand Tank	Golden Spray	2.6	40	7.14	5.6	112	18.48

The man hours include spraying time only.

The pressure tank was a tank built for experimental use. The pressure was supplied from an air cylinder for the experiment. The tank was shaped like the Smith knapsack tank and by a system of spring valves a constant pressure was maintained. Thirty-five pounds pressure was used in this test. On the hand tank, the regular single action Smith pump was used. For hand pumping the Golden Spray nozzle, which has the largest outlet of the three nozzles used in the test, had to be used on account of the difficulty to force enough solution thru a smaller nozzle to spray a bush, by the use of the single action hand pump. The special nozzle with the finest outlet proved to be impractical on account of the time required to apply a sufficient amount of spray on a bush. The results indicate that the No. 111 Fine nozzle is the most practical, since the 20% saving on solution, as compared with the Golden Spray nozzle, more than equals the extra time required for application.

Since the pressure tank was not constructed for practical use, the experiment does not represent a test on the practicability of a pressure tank. A recent trial of double action hand pumps has demonstrated the fact that a pressure of 50 pounds can be maintained without the operator becoming fatigued. This will permit the use of the No. 111 Fine nozzle on the hand pump. If a suitable pressure tank can be constructed there is field for large scale comparison between such equipment and the double action hand pumps.

2. An effort is being made to develop knapsack equipment which is more easily carried by the men. Pack boards are being constructed and canvas knapsacks are being designed which will be given a thorough test.

VI. Recommendations for Future Work in Chemical Eradication Methods.

1. A comparison of hand pulling, knapsack and power spraying in the lighter Ribes concentrations. In Ribes concentrations of 5% and above, it has been clearly demonstrated that chemical eradication is the most practical.

2. Further perfection of knapsack and power methods and a comparison of both units in all Ribes concentrations.

3. Development of a suitable knapsack and power equipment.

EXPERIMENTAL RIBES ERADICATION ON COEUR D'ALENE NATIONAL FOREST, IDAHO

By
W. G. Guernsey,
Junior Forester

INTRODUCTION

The experimental hand eradication program was continued in 1928 on the Coeur d'Alene National Forest. The object of continuing on this forest was to complete the area begun in 1927 and to check upon an area on which pre-eradication was conducted in 1927.

The completion of drainages begun in 1927 would leave a large area as an example of large scale experimental Ribes eradication. Here it will be possible to observe the effect of hand pulling Ribes as a means of controlling blister rust when it becomes established in the general region.

1928 was the first season during which the entire hand pulling eradication operation was decentralized. This was in contrast to previous seasons when all units were located in the same general locality and served by the same supply system. The purpose was partially to secure experience with the decentralized type of organization in preparation for the future.

I. Purposes

In general the purposes of the 1928 work in eradication of the hosts of white pine blister rust were:

1. To continue complete eradication of all Ribes on white pine areas as a further study of costs and effectiveness of such control.

2. To give protection to white pine timber on given areas.

3. To destroy Ribes in a complete drainage on stream and reproduction types only as an experiment for determining effectiveness and cost of that type of control.

4. Development of personnel for future work.

5. To provide a going field operation as a laboratory for methods and efficiency studies.

II. Location and Description of the Area.

The Coeur d'Alene National Forest in the northern part of Idaho was the center of Ribes eradication by hand pulling methods in 1928.

The two units operating on the forest were split as a part of the decentralization plan to obtain cost and experimental data in different localities for practical control purposes.

The first unit worked on Picnic, Little and Barney Creeks, draining into the Little North Fork of the Coeur d'Alene River. The operations were located in T. 51 N. and T. 52 N. R. 1-2 W., Boise principal meridian.

Mature white pine predominated with a small percentage of cutover and white pine reproduction.

The second unit operated in the Marie Creek district, in T. 50 N. R. 1-2 W. of Boise principal Meridian, and is drained by Marie Creek into Coeur d'Alene Lake.

The area worked was classified as white pine type with heaviest pine on moist slopes and bottoms. Lodgepole, Douglas fir, larch and yellow pine increased as the sites became less favorable for white pine.

The topography in both is practically the same with steep slopes, talus formations on higher points, and elevations varying from 3,000 to 5,000 feet.

III. Methods and Equipment

Experience in former years pointed out the advantage of two, three and four-man crews with foremen working in line. These sizes of crews, especially the three-man crew, proved most successful and practical. The methods report expands on the crew sizes and brings forth some interesting details to explain the reason for the success of the three-man crews. From a supervisor's standpoint this size crew is easily handled and when in charge of experienced foremen perform their work in a very satisfactory manner. When the crews are small, men of the same type and habits can be worked together. This assists in handling the personnel with increased output of work.

The foreman of each crew carried a small trench pick to assist in removing the larger bushes. The pick is light, easily carried, and when necessary can be passed to the other members of the crew without loss of time or effort.

A $1\frac{1}{2}$-ton capacity G.M.C. truck purchased at the beginning of the 1927 season, handled the transportation of men, supplies and equipment.

Especial thanks are accorded the Winton Lumber Company for their permission to use a cabin as warehouse and general headquarters.

The packing of supplies from warehouse to camp was taken care of by a packer and string of six mules and saddle horse. While this size of pack string was necessary to keep the camps supplied, it could also have taken care of another camp and resulted in lower subsistence costs.

After the success found in 1927 with the 25-man camp, it was decided to continue the practice in 1928. Consequently both Camps 1 and 2 averaged about twenty-two Ribes pullers, a cook, flunky and camp supervisor.

The two units, as pointed out earlier in the report, were situated at some distance from each other to facilitate obtaining experimental information.

The first unit, Camp 1, was first located on the Picnic Creek area. This area was large enough that when eradicated would give essential information on stream and reproduction eradication. By completing this experiment the advantages or disadvantages of stream and reproduction type eradication over entire or complete eradication of all types could be explained by comparison. Former studies and observations relative to the great susceptibility of the two Ribes species found on stream type (R. petiolare and Grossularia inermis) and the abundance of the two lesser susceptible Ribes species on reproduction and cutover areas (R. viscosissimum and R. lacustre) resulted in recommendations for stream and reproduction eradication as a control measure. The Ribes concentrations were found in or along the edges of stream type. These concentrations along streams and moist places were found to be most susceptible to blister rust infection. So this immediately led to the above-mentioned idea of stream and reproduction type eradication.

The Picnic Creek area can be compared with the Cascade Creek area eradicated in 1927. The Cascade Creek area was completely eradicated with close formation crews in stream and reproduction and scout or extensive crew formations on the hillsides. Two tables giving the essential information for comparison are found following these statements in the report.

After completing the Picnic Creek area, Camp 1 moved up the Little North Fork of the Coeur d'Alene River to Little Creek. In the Little Creek area conditions were different from any found to date on the Coeur d'Alene Forest.

The stream type of this area consisted of Class D concentrations of Grossularia inermis and Ribes lacustre. This increased the cost of hand pulling above the average found for this season. The lands adjoining this area to be worked in the future have no such concentrations and will be eradicated with less expenditure of money and time.

The stream and reproduction type eradication was continued on the Little Creek area. The dense concentrations found were unlike any areas eradicated in former years so it was considered inadvisable to bring about any comparison.

To continue the experimental control and working methods for unit number two, the Marie Creek area was picked for its general silvicultural working conditions and as a check on a pre-eradication survey made in 1927. The Marie Creek area also offered a variation in Ribes concentrations from R. lacustre and G.inermis on the Little North Fork to a drier site with varied Ribes concentrations of G.inermis to R. viscosissimum.

On this area all phases of crew work were carried on. Scout and regular crew formations were used on areas having sufficient Ribes. Pre-eradication work done by the checking crew in advance determined which areas were sufficiently free of Ribes to eliminate close formation crews.

The pre-eradication work done in the fall of 1927 assisted in planning the work and locating camp sites in addition to giving general information of the area. This system consisted of locating type lines by triangulation survey (with the aid of field glasses) followed by check strips across each type. From a basis of former costs per acre on each type, and information secured by pre-eradication, an estimate was made of the probable cost of eradicating Ribes from the Marie Creek drainage. Further details of the work completed in the pre-eradication survey may be found in the 1927 report for this area.

IV. Results of Work

TABLE NO. 1

SUMMARY OF RESULTS OF RIBES ERADICATION
ON THE COEUR D'ALENE NATIONAL FOREST
1928

Type	Ribes Pulled					Man Days		Acreage	Ribes Per Acre	Cost Eradication Per Acre
	R. lac.	R. viscos.	R. pet.	G. inermis	Total	Crewman	Foreman			
Dense Mature	15,047	343		13	15,403	31.14	15.54	182.10	84.6	$ 1.90
Open Mature	164,613	7,991		120	172,724	213.50	101.75	586.60	294.4	3.97
Dense Pole	21,050	7,497		197	28,744	80.50	33.50	695.35	41.3	1.21
Open Pole	34,689	13,528			48,217	111.63	54.75	1,042.65	46.2	1.18
Dense Reproduction	24,793	8,867			33,660	77.40	37.77	345.60	97.4	2.48
Cutover Mature	71,955	81		1,190	72,266	141.20	58.10	226.00	324.0	6.51
Stream	344,349	2,555	125	58,847	405,259	767.14	306.53	721.07	562.0	11.07
Ribes free								5,540.03		0.11
Total	676,496	40,862	125	60,367	777,850	1,422.94	607.94	9,340.30	83.3	$ 1.67

The above table constitutes a summary of the entire progress made by both units on Coeur d'Alene in eradication of wild Ribes for the 1928 field season.

TABLE NO. 2

RESULTS ERADICATION CAMP 1 - PICNIC CREEK

	Ribes Pulled					Man Days				
Type	R. lac.	R. vis.	G. inermis	R. pet.	Total	Crewman	Foreman	Acreage	Ribes Per Acre	Cost of Eradication per Acre
Dense Mature	6,033		13		6,046	11.25	6.13	35.40	170	$3.08
Open Mature	4,707	116	70		4,893	7.50	3.75	17.85	274	3.96
Cut Over	24,690	1	1,190		25,881	65.00	22.50	75.50	342	7.17
Stream	62,349		12,200	125	74,057	156.15	67.62	226.82	326	6.25
Ribes Free								1,624.43		0.17
Total	97,779	117	13,473	125	111,494	239.90	100.00	1,980.00	56	$ 1.22

The above table is a summary of the progress of the stream and reproduction type eradication experiment. It will be noted that a small acreage of dense and open mature tumber was also worked. These two instances represent a case where dense and open mature timber was located on flats adjacent to mature timber or on hillsides where there was enough seepage to favor heavy growth of R.lacustre. It was deemed advisable to work these few acres concerned while the unit was located on the area. However, most of the mature timber was practically free of Ribes.

TABLE NO. 3

RESULTS ERADICATION CAMP 4 - CASCADE CREEK
1927

Type	Ribes Pulled				Man Days				Acreage	Ribes Per Acre	Cost of Eradication Per Acre
	R. lacustre	R. viscos.	G. inerm.	Total	Crewman	Foreman	Scout	Total			
Dense Mature	2,930	3		2,933	9.54	7.87	9.25	26.62	335.5	22.0	$ .51
Open Mature	143,674	5,736	125	149,535	252.56	116.25	201.75	580.56	2,836.5	52.7	1.36
Dense Pole	16			16	.24	.25	.43	.75	50.0	.3	0.095
Open Pole	659	5		664	7.50	3.14	3.87	14.50	198.3	3.3	.47
Open Reprod.	4,943	8,231		13,174	3.35	10.75	27.55	41.50	22.5	585.5	11.92
Cut Over	67,234	2,830	377	70,441	206.43	58.00	30.25	294.62	285.5	246.8	6.66
Stream	103,768	3	16,454	120,225	304.43	69.61	17.50	391.50	144.9	829.9	17.43
Total	323,224	16,808	16,956	356,988	783.65	275.87	290.50	1,350.60	3,873.2	92.2	$2.28

Table No. 3 is a reproduction of the table included in the 1927 report. It is included here so that the results can be compared with those shown in Table No. 2. Table No. 2 is the result where only stream and reproduction types are worked and the total cost applied against the entire acreage drained by streams on the area. While the Picnic and Cascade Creek areas are quite comparable in every manner except stream type, stream type on the Cascade Creek area was more profuse with Ribes than on the Picnic Creek area. In general there is a difference of $1.08 per acre in costs where only stream and reproduction are worked as against all types being worked.

W. 647. Classes C and D stream type on Little North Fork of Coeur d'Alene River, Idaho. 1927-1928 eradication area.

W. 427. 3-man crew working in Class D stream type, Nicholas Creek, Coeur d'Alene National Forest, Idaho.

TABLE NO. 4

RESULTS ERADICATION CAMP #1. LITTLE & BARNEY DRAINAGES

Type	Ribes Pulled				Man Days		Acreage	Ribes Per Acre	Cost of Eradication Per Acre
	R. lac.	R. vis.	G. inerm.	Total	Crew-man	Fore-man			
Dense Mat.	6,893	6	50	6,949	15.2	7.1	38.0	182	$ 4.09
Open Mat.	58,523	62		38,585	83.5	43.0	91.9	419	9.63
Cut over	47,265	80		47,345	76.2	35.6	150.5	314	5.23
Stream	138,918		37,892	176,810	293.7	123.0	219.7	804	13.28
Ribes Free							999.9		.12
Total	251,599	148	37,942	289,689	468.6	208.7	1,500.0	193	$ 3.21

Results of work shown above represent a condition as previously described where stream and cutover types represent an unusually high percentage of the total area.

TABLE NO.5

RESULTS ERADICATION CAMP #2, MARIE CREEK AREA

Type	Ribes Pulled				Man Days		Acreage	Ribes Per Acre	Cost of Eradication Per Acre
	R. lac.	R. visco.	G. iner.	Total	Crew-man	Fore-man			
Dense Mat.	2,121	337		2,458	4.68	2.1	108.4	22	$ .53
Open Mat.	101,383	7,813		109,196	122.5	55.0	476.85	228	3.00
Dense Pole	21,050	7,497	197	28,744	80.5	33.5	695.35	41	1.32
Open Pole	34,689	13,528		48,217	111.12	54.75	1,042.65	46	1.29
Dense Rep.	23,749	8,867		32,616	76.5	36.10	341.8	95	2.57
Stream	144,126	1,962	9,348	155,436	318.35	116.00	279.25	556	12.54
Ribes Free							2,915.70		.08
Total	327,118	40,004	9,545	376,667	713.65	297.45	5,860.0	64	$ 1.39

The results shown here apply to the area on which pre-eradication was done in the fall of 1927. It is a part of the 10,000 acres. The estimate for the entire area was $1.26 per acre for Ribes eradication. Since the part worked included all the heaviest stream type, and most of the other areas having numerous Ribes were worked, it is felt that if the entire 10,000 acres could have been completed, the estimated cost would have been very accurate.

Due to the numerous variations found when using the present eradication types the scheme of classifying areas into the classes enumerated below wherein each class represents a distinct set of conditions calling for a special way of working, was tried as an experiment on a limited scale.

The eradication classes are A - B - C - D and E. No Class B and E areas were worked by Camp 1. Camp 2 had all classes but the old eradication type system of classifying areas was still used.

In Class A a crew of three men can work from 50-125 acres per day having from 0-10 Ribes per acre.

In Class B a crew of three men can work from 12-50 acres having from 10-40 Ribes per acre.

In Class C a crew can work from 3-12 acres per day having from 41-300 Ribes per acre.

In Class D a crew can work from ½-3 acres per day having 300 or more Ribes per acre.

Class E is a type best suited to chemical eradication where there are Ribes concentrations so dense that it would be too expensive to eradicate with a crew of hand pullers.

The Ribes data are also completed by classes on the Little North Fork area and can be found in the following table:

TABLE NO. 6

RESULTS ERADICATION CLASSES CAMP #1

Locality	Erad. Class	Ribes Pulled					Man-days		Acreage	Ribes Per Acre	Cost Eradication Per Acre
		R. lac.	R. visco.	G. inerm.	R. pet.	Total	Crew-man	Fore-man			
Picnic Creek	C	97,779	117	13,473	125	107,494	239.8	99.98	355.47	332	$ 6.43
Little Creek & Barney "	C	52,400	114			52,514	87.0	41.00	166.70	315	5.15
Little Creek & Barney "	D	199,199	37	37,942		237,178	381.2	167.7	332.40	713	11.13
Ribes Free	A								2,625.33		.15
Total		349,378	268	51,145	125	401,186	708.0	308.7	3,480.00	115	$ 2.08

It was deemed advisable to avoid discarding the eradication types which had been so carefully developed. Hence, all efforts so far toward classifying areas constitute a first step in determining the feasibility of such a move. From success with the system to date it warrants an extensive trial in 1929.

V. Statement and Analysis of Cost

1. Cost Analysis. Table No. 7 gives the detailed costs of the two camps, and the percentage relationship to the total expenditures.

In pointing out the expense items and percentage relationship in the following table it is interesting to note the general average of salaries and subsistence figures. This relationship has been found to exist when comparing the figures with other twenty-five men units.

The value in such a table lies in the fact that a supervisor may effect economies more readily by paying especial attention to those items which seem to be above the average for similar projects.

TABLE NO. 7

COST OF ERADICATION CAMPS

Expense Items	Camp 1		Camp 2		Camps 1 and 2 Combined	
	Cost	Percentage of Total Cost	Cost	Percentage of Total Cost	Total Cost	Percentage of Total Cost
Salaries	$4,316.45	59.59	$4,607.75	55.02	$8,924.20	57.14
Subsistence	2,276.35	31.42	3,079.96	36.78	5,356.31	34.29
Equipment	185.29	2.56	185.29	2.21	370.58	2.37
Transp.Equip.	189.75	2.62	189.75	2.26	379.50	2.43
Transp. Men	122.99	1.69	123.00	1.47	245.99	1.57
Misc.Supplies	59.76	.82	59.75	.71	119.51	.76
Twine	81.00	1.12	117.00	1.39	198.00	1.27
Misc.Expenses	12.22	.18	12.23	.16	24.45	.17
Total	$7,243.81	100.00	$8,374.73	100.00	$15,618.54	100.00

2. Comparison of Government owned transportation with private transportation.

The following cost figures give the detailed expenses for transportation during the 1928 eradication season:

Actual costs by Government truck:

Freight between Spokane and Honeysuckle Ranger Station by Government truck	$525.89
Men between Spokane and Honeysuckle Ranger Station by Government truck	78.00
Total	$603.89

Lowest commercial rates for hauling were:
Freight, Spokane to Honeysuckle Ranger Station - $0.75 per cwt.
Freight, Coeur d'Alene to Honeysuckle Ranger Station -$0.45 per cwt.
Men, Spokane to Honeysuckle Ranger Station - $2.50 each

Costs had hauling been done by private company:

Freight	$458.36
Men	300.00
Total	$758.36
Actual cost by Government truck	603.89
Amount saved by Government truck	$144.47

In addition to this actual saving on the transportation of freight and men there is another item. Had hauling been done by a private company it would have been necessary to maintain a warehouseman at Honeysuckle. With the system used the truck operator, who was one of the year-round employees of the Office of Blister Rust Control, handled the warehousing in addition to his regular duties. The minimum cost of maintaining a warehouseman at Honeysuckle would have been $360.00 for the season.

VI. Recommendations

In analyzing the report for the 1928 season it is noticeable that several factors tend to reduce the cost and simplify the management of hand eradication. The following recommendations are made:

The first recommendation is the continued use of smaller crews, preferably three-man crews with the foreman working in line. This recommendation is supported by the findings of the methods crew.

The second recommendation is the continuation of stream and reproduction eradication.

In studying over the detailed data taken on the completely eradicated versus stream and reproduction eradicated areas the eradication cost per acre of the latter is about one-half that of completely eradicated areas. In future years, should both areas become infected with blister rust, interesting studies can be obtained by comparing the amount of damage on the two areas.

In regard to the results on Marie Creek and checking these details with the pre-eradication survey of 1927, it is interesting to note the comparison. Pre-eradication in 1927 resulted in an estimate of $1.26 per acre for eradication. The actual cost of the eradicated area completed was an average of $1.43 per acre. The part not eradicated in the area was mostly Ribes free, and it is relatively certain that when the area is completed, it will average around $1.30 per acre or lower.

This leads to the conclusion that pre-eradication is essential in areas where conditions are unknown and that such practice simplifies eradication management.

ERADICATION METHODS REPORT

By

H. E. Swanson, Agent

Introduction

Methods study was made a separate unit under the eradication project. As a part of this project, methods had the advantage of practical application for all ideas developed by experimentation.

I. Purpose

The chief purpose of the methods study is directed toward that end which will lower costs and increase efficiency in the eradication of wild currants and gooseberries. In the accomplishment of its aim, this project endeavors thru observation and experimentation in all the details of the work, to bring to light valuable information which is missed by large scale eradication. Such discoveries are given a thorough trial and their worth determined by practical applications.

II. Location

The methods study was carried on in the Coeur d'Alene National Forest on the same areas and in conjunction with both camps of the eradication project.

III. Organization of Work

The work was conducted by a project leader and four assistants. Two assistants were stationed in each camp to carry out experiments previously outlined by the project leader, who divided his time between the two camps. Actual eradication crews were used to carry out all experiments, while the methods men accompanied the crews taking the necessary data. The experiments were so conducted as to not interfere with actual eradication. All experimental areas were measured by chain after the experiment was completed. The methods men made the final recheck for missed Ribes.

IV. Cost of Project

1.	Salaries	$1,133.82
2.	Subsistence	516.36
3.	Equipment	85.00
4.	Special equipment	29.10
	Total	$1,764.28

V. Work Performed and Results Obtained

The work in general consisted of ten experiments, which are hereafter described and in some cases illustrated by graphs and charts.

Experiment No. 1. Test on Value of Experience

1. Purpose. To measure the output and efficiency of men with one or more seasons' experience in Ribes eradication with that of inexperienced men.

2. Method. The experienced and inexperienced crews were worked in the same area on alternate strips for a period of five days at the beginning of the season, and again for a period of one day during the later part of the season. The new men were taken without any preliminary training. An experienced man, acting as a trainer, instructed the new crew on the first two days of the test. Data were taken from the start.

3. Results. This experiment was performed in two camps, and although the results were somewhat different in each camp, they indicate a common principle.

A. Marie Creek. See Plate I. The experienced crew consisted of four men having one year's previous training in hand eradication, and who had shown up exceptionally well during the previous season. Four inexperienced men were chosen at random and formed into a crew. As the season progressed, it developed that these inexperienced men were above the average or exceptional and were of the same caliber as the experienced men with whom their work was compared.

The charts show that after the first day there is no appreciable difference between the work of the experienced men and that of the inexperienced men either in output or efficiency, there being only a slight advantage in favor of the new men. The same relation between these two crews existed at the end of a month's work, as at the beginning of the season. A month's experience had not changed the relation of the new men to the experienced men. Since the crews were of the same caliber and the work was performed on comparable areas, the results of this test indicate that experience in ordinary crew labor is of no great value. As indicated by this experiment together with observations during the season of the various types of men, that as far as output and efficiency of work are concerned, men are divided into two classes, not on the basis of experience, but on the basis of general ability and aptitude for Ribes eradication work. The experiment showed that good men whether experienced or inexperienced put out the same amount and type of work. Observation showed that experienced men who had not shown up well during the previous season were doing about the same amount of work with the same efficiency as new men of the same class were doing.

Consequently a good experienced man is worth re-employing at a higher wage for ordinary Ribes pulling, not because of his experience in

PLATE I

Test on Value of Experience

Marie Creek - Camp 2

Experiment
12 crew days
20 acres St.
600 Ribes per A.

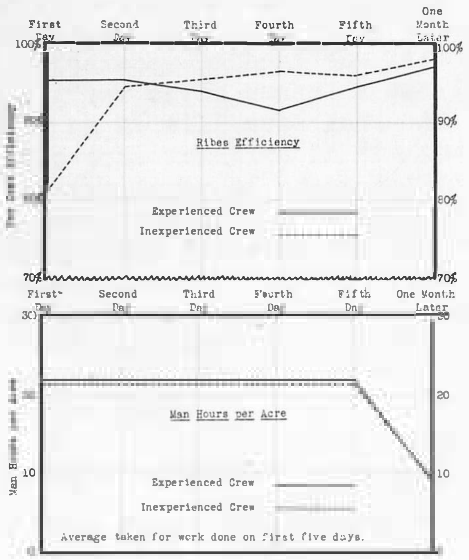


PLATE II

Test on Value of Experience

Little North Fork - Camp 1

Experiment
12 crew days
42 acres O.R.
225 Ribes per A.

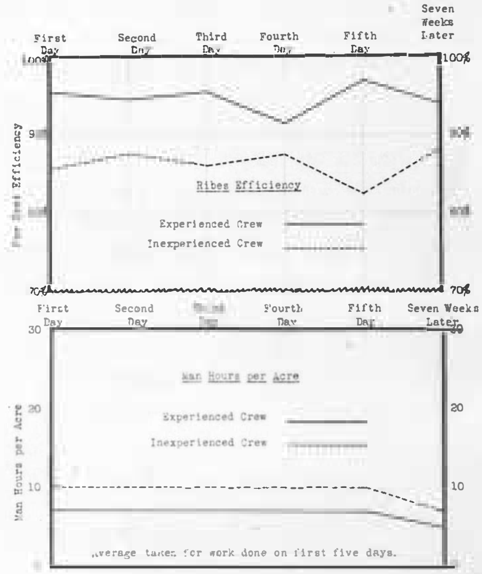


PLATE III

Experiment on Size of Crew

Chart 1

String Lines Laid in Advance for Crews

Experiment
11 man days
8 acres O.R.
300 Ribes per A.

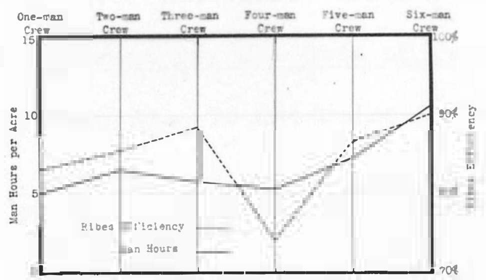
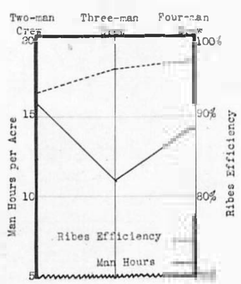


Chart 2

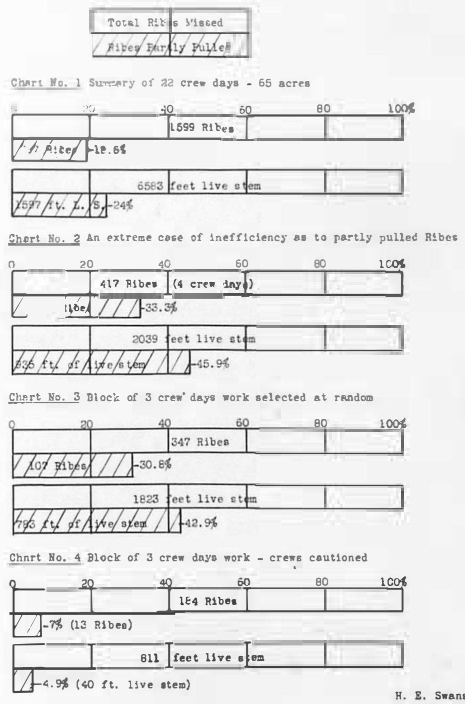
Crews Laying Own String Lines



Experiment
19 man days
8 acres St.
700 Ribes per A.

PLATE IV

Study on Ribes Efficiency in Hand Eradication
Partly Pulled Bushes



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hand eradication, but because he is a good man. On the other hand, a poor experienced man is not worth re-employing even at the same wage on the basis of his experience, because that experience will give him no advantage over even a poor new man. It is better to take a chance on the new man for he may prove to be a good worker.

B. Little North Fork. See Plate II. The same test was made in this camp as on Marie Creek. However, in this case, it was seen as the season progressed that the experienced crew had the better workers. The results of the experiment showed that the experienced crew performed more work at a higher efficiency both at the first of the season and at the last of the season. After seven weeks, a man is about as experienced in eradication crew work as he will ever get. As in the test made at the camp on Marie Creek, the same relation in the output and efficiency of work existed between the two types of crews during the last part of the season, when all the men were experienced as existed between the two crews at the start of the season, when one crew was composed of experienced and the other crew of inexperienced men. On Marie Creek, the men were all of the best class of workers and consequently their output of work and efficiency was about equal, while on the Little North Fork, the new men were not as good as the experienced men, which would account for the difference in the level of output and efficiency of their work throughout the season.

4. Conclusions

a. Experience in ordinary eradication crew work is of no appreciable value.

b. Men are divided into two general classes, as far as the output and efficiency of work is concerned, not on the basis of experience, but on the basis of general ability and aptitude for Ribes eradication work, the good men being worth re-employing at a higher wage according to their ability, while the poor man is not worth re-employing at even the lowest rate.

Experiment No. 2. Size of Crew.

1. Purpose. To determine the most practical size of crew.

2. Method. In this experiment, all the variable factors were eliminated as far as possible to get the test on the one variable, the number of men in the crew. The human factor was eliminated by using the same six men throughout the whole experiment and using each man in each size of crew. The difficulty factor was largely eliminated by selecting an area that was uniform and then alternating the strips for the various crews. The number of Ribes on the strips did not vary greatly, and by the use of a stop watch in taking the pulling time on each strip, proper adjustment was made for any difference occurring in the number of Ribes. On one area, the string lines were laid in advance for the crews; on another area the crews laid their own string lines.

3. Conclusions: See Plate III. Both cost and efficiency increase as the size of the crew increases. The waiting factor on the part of the

men in the larger crews, together with the bulkiness of such crews accounts for the increase in costs. This slower progress in turn permits more searching time and accounts for the increase in Ribes efficiency. However, there is not much difference in the efficiency between a three-man crew and larger crews. The three-man crew appears to be the most practical from the standpoint of both cost and efficiency.

Note: Further comparisons were made of the three-man and four-man crews. A discussion of their relative merits on the basis of these comparisons and studies follows:

Comparison of Three and Four Man Crews.

Facts in addition to the experiment showing the relation between costs and efficiency of the various sizes of crews,

1. Same width of strip taken by three and four man crews. Check made on four days work for both crews using the same men in each crew and on the same area, show the same average width of strip.

2. Laying string line does not noticeably interfere with a man's output of work.

a. Check on 12 days work with a four-man crew shows the following results in regard to the average number of Ribes pulled per day by each man in line.

No. 1 man	206 Ribes per day
No. 2 man	195 " " "
No. 3 man	191 " " "
No. 4 man (laying string line)	199 " " "

b. Similar check on 11 days work with a three-man crew.

No. 1 man	260 Ribes per day
No. 2 man	249 " " "
No. 3 man (laying string line)	245 " " "

The experiment on the size of crews shows that the three and four-man crews are the most practical (that is, exclusive of one and two man jobs where string lines are not laid). For this reason, further study was made on three and four man crews. Considering the waiting factor and the bulkiness of the larger crews, which is the reason for the higher cost per acre in their cases, the three-man crew is preferable to the four-man crew. On the other hand in the case of the smaller crews, the width of strips and the laying of string are the only two factors which might counteract the advantages of the smaller crew. However, a check upon both of these items shows that the three-man crew takes just as wide a strip as the four-man crew and that the laying of string line does not interfere to any appreciable extent with that man's output of work.

Observation also verified these checks and provides an explanation for them. In the crew with four men in line, the tendency is

always for the intervals between the men to narrow and it often happens that one man is found going over the same path taken by his neighbor. There is also the overlapping of intervals and the difficulty of maintaining a uniform strip, which is increased by the presence of a fourth man. When there are four men, the two outside ones are not prone to help each other. A man's assistance is usually given to his neighbor only, and he does not go further unless called. In other words, the four-man crew is not as compact a unit as a three-man crew and teamwork is not so effective. The three-man crew is able to take as wide a strip or rather its width of strip will average that of a four-man crew because the tendency for the intervals to narrow down is eliminated. The men are not found following in one another's footsteps, for if they did, the string lines would be brought too close together. The two outside men are able to keep track of each other. With only three men, any duplication or narrowing of interval is very noticeable, consequently the tendency is to keep the proper interval and to widen if necessary. The true explanation then of the reason that a four-man crew takes no wider interval than a three-man crew is the fact that the organization with four men in line does not take the width of strip which it is capable of taking, while a three-man line maintains its proper width of strip.

The simple method of carrying the ball of string is the reason why it does not interfere with a man's work. He is able to drop it or throw it ahead of him and give all his attention to pulling Ribes.

It is on the basis of these experiments and observations, along with a thorough trial in practical application that the three-man crew is recommended for all hand eradication, exclusive of only such areas that are a one or two-man job.

<u>Experiment No. 3. Study on Ribes Efficiency in Hand Eradication Partly Pulled Bushes</u>

<u>1. Purpose.</u> To improve Ribes efficiency by the elimination of partly pulled bushes.

<u>2. Method.</u> In making a check upon crew work, a record was taken as to whether the bushes missed by the crew were partly pulled or missed entirely.

<u>3. Conclusions.</u> See Plate IV. The results show that partly pulled bushes constitute a large part of the missed Ribes. Consequently, by eliminating such misses the efficiency can be increased. In a somewhat extreme case of inefficiency as to partly pulled bushes, 24% of the missed Ribes and 38% of the missed live stem was eliminated by giving the crews specific instructions how to avoid leaving partly pulled bushes. Taking the general average over all the work checked of the relation of partly pulled bushes to the total number of misses, it is possible to eliminate 12% of the total bushes missed and 19% of the total live stem missed by

giving all crews proper instruction as to partly pulled bushes. Crews must be constantly reminded of this danger, otherwise they drift back to carelessness.

There are several factors to be considered in order to obtain a higher efficiency in regard to partly pulled Ribes, and these features must be eliminated from crew work, before this higher efficiency can be obtained.

1. Careless pulling or jerking is the cause of missed crowns.

2. Tramping unpulled Ribes under feet when working in a concentration. A systematic approach will prevent this. All Ribes should be pulled as one moves ahead, rather than to start in the midst of a clump of bushes.

3. Failure to remove pulled bushes and to pile or hang them away from the Ribes site. If this is not done, unpulled bushes are invariably concealed beneath pulled bushes.

4. Leaving fragments of live stem on the ground. These appear as merely broken off tips or branches when in fact they are often attached to a root.

5. When a man helping his neighbor fails to complete his job by cleaning up the spot on which he has been working.

6. Pulling the bushes by the tips or away up on the branches, instead of taking hold of a firm portion of the bush nearer the base.

7. Failure to make a final check where a large amount of live stem has been pulled.

This carelessness contributing to the leaving of partly pulled bushes can be eliminated without any noticeable increase in time, in fact the fastest way to pull a bush is also the best way to get the whole of it.

<u>Experiment No. 4. Study on Uphill-Downhill-Contour Work.</u>

<u>1. Purpose.</u> To determine the most practical and efficient method of working hillsides.

<u>2. Method.</u> Work performed uphill, downhill and on contour by the same crew and accurate record kept of all work and final check made of the entire area.

<u>3. Conclusions.</u> See Plate V.

In the past, the method has been to work uphill and then along

the contour. The size of the hill made this method necessary in some cases. Downhill work was avoided because it made for a low efficiency. However, the results of this experiment indicate that Ribes efficiency, highest in the case of uphill work, was the same in the work performed downhill and on the contour, while both downhill and uphill work were performed at a lower cost, the contour work being approximately 50% higher in man hours required.

Since the experiment was done on only a small scale, the area is not sufficient upon which to base any final conclusions, but it does indicate an important field for further experimentation and warrants a test on an extensive scale. For the coming season, this probably represents the most important experiment for methods study in hand eradication.

Note: With the changes occurring in crew organization and the individual responsibility resulting therefrom, past findings in regard to the inefficiency of downhill work may not hold true with the present three-man crew.

Experiment No. 5. Difficulty Factor. Effect of Slope on Travel Time

1. Purpose. To determine the difficulty factor in Ribes eradication represented by various degrees of slope, and to measure the effect of slope upon cost per acre.

2. Method. The difficulty factor of slope was measured by taking the travel time of a three-man crew on various degrees of slope.

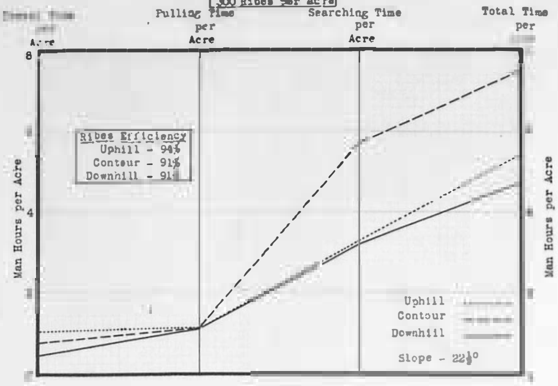
3. Results. See Plate No. V.

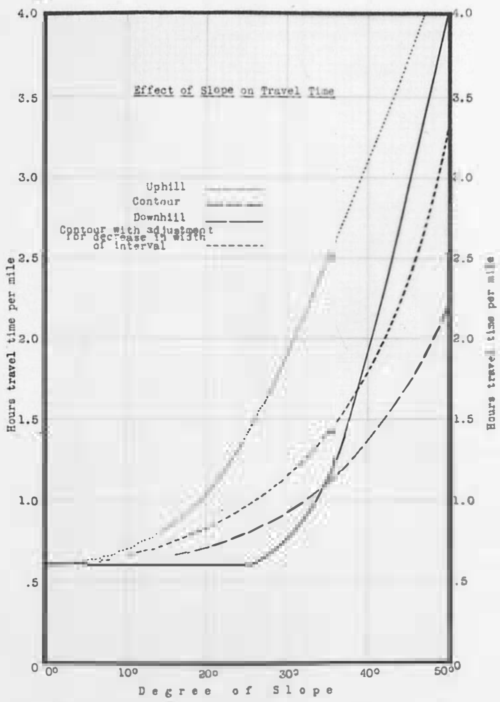
In regard to the effect of slope on width of interval in contour work, it might be presumed that the men on the crew would takenan interval by a rough estimation of the distance on the ground surface of a slope as they do on the level, thus making the decrease in interval equal merely to the loss in horizontal distance. However, the loss is greater than this probably caused by the fact that the men are not inclined to work as wide an interval when they have to go up and down hill to do it.

PLATE V

Study on Uphill - Downhill - Contour Work

Experiment
6 acres
300 Ribes per acre





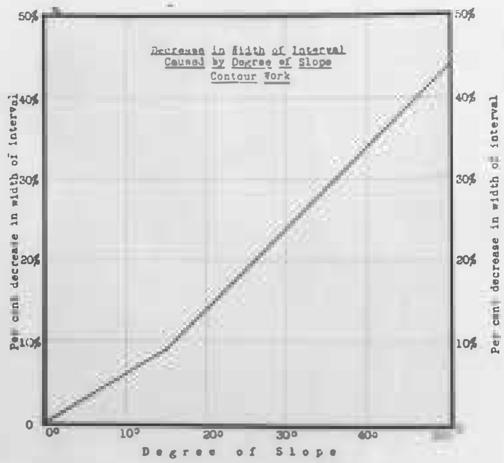


PLATE VI

Test on Accuracy of Ribes Count by the Regular Eradication Crews

Experiment
Total crew days checked - 32
Number of crews checked - 12
Number of men checked - 40

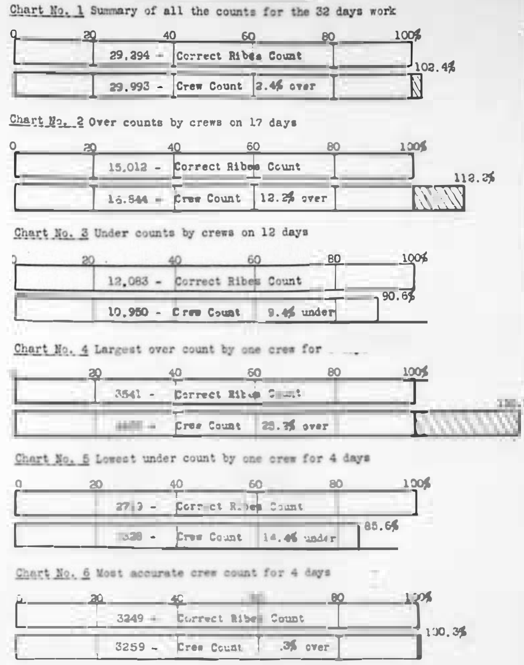


PLATE VII

Travel Time - Pulling Time - Searching Time

Experiment
15 crew days
32 acres

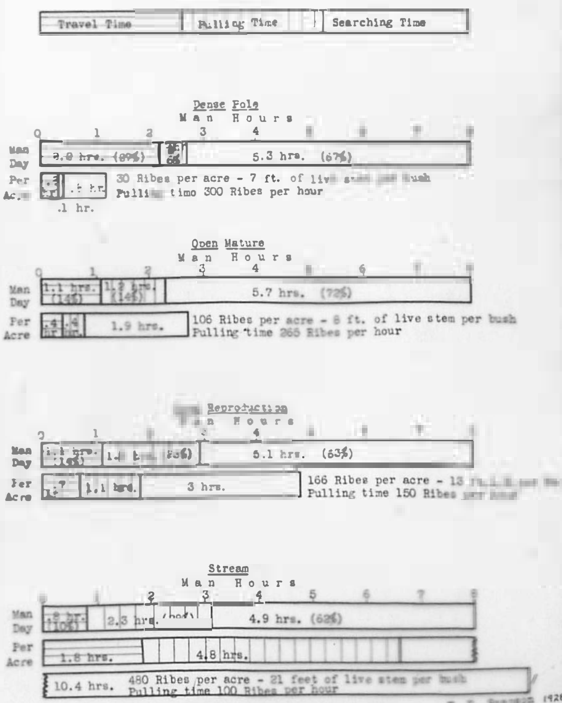


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TABLE NO. 1

INCREASE IN TRAVEL TIME PER ACRE CAUSED BY SLOPE

Slope	Uphill				Downhill				Contour			
	Class A	Class B	Class C	Class D	Class A	Class B	Class C	Class D	Class A	Class B	Class C	Class D
Gentle 5°-15°	1'	2'	4'	5'	0	0	0	0	0	0	0	0
Medium 15°-30°		9'	18'	27'	0	0	0	0	1'	4'	7'	11'
Steep 30°-40°	9'	27'	54'	1:21'	2'	7'	14'	22'	4'	11'	22'	32'
Precipitous 40°-60°	19'	57'	1:54'	2:53'	17'	51'	1:42'	2:33'	14'	41'	1:23'	2:4'

Time expressed in hours and minutes, e.g. 1:54' = one hour and 54 minutes.
Width of interval per man:

Class A - 1.5 chains
Class B - .5 chains
Class C - 1/4 chain
Class D - 1/6 chain

Experiment No. 6. Accuracy of Ribes Count by Regular Eradication Crews

1. Purpose. To determine the degree of accuracy of the Ribes count submitted by eradication crews.

2. Method. A recorder accompanied the crew taking count of each Ribes pulled by each man. This accurate count could not be secured without the men knowing that they were being checked on. There is probably no man, who has pulled Ribes, who has been able to make a real count of the Ribes he pulled, where they have been at all numerous. Ribes counting is done by estimating rather than by actual counting.

3. Conclusions. See Plate VI. The results show that when an effort is made to give a fair estimate as to the number of Ribes pulled, a reasonable degree of accuracy is obtainable. Then the average of the over counts and the under counts in the total number of Ribes pulled on an area gives a very high degree of accuracy.

Another experiment showed that the various men on the line will, over a period of time, pull about the same number of Ribes. If all the members of a crew can not be relied upon to give a fair estimate, the foreman can take his own count and base the count for the crew upon that. In this experiment, each man on the crew heard the counts submitted by the other men and was able to judge his own estimate on those previously submitted. This is a desirable feature because it tends toward a more sound estimate. This feature could be used to a better advantage by taking the count of the member of the crew known to give the fairest estimate before any of the others.

This counting or estimating Ribes takes no time from the actual work and it is only a matter of a few seconds to take the counts of the members of the crew. In view of this fact together with the high degree of accuracy in the count, it is very desirable that in all investigative or experimental work in Ribes eradication, that the Ribes count be taken as in the past.

Note. There have been cases in all the eradication camps, where the question of Ribes counting has been regarded as a joke and held up to ridicule by members of the crew. Such an attitude on the part of a few will tend to cause laxity among the others in the counting of Ribes. The experiment has shown the degree of accuracy obtainable when an effort has been made to give a fair estimate, and any cases of bad faith as referred to above, should be dealt with as the situation demands.

Experiment No. 7. Travel Time - Pulling Time - Searching Time.

1. Purpose. To determine the actual time spent in travel (time to walk over area), pulling Ribes (time for actual pulling and disposing of the bushes), and searching for Ribes (time in addition to travel and pulling).

2. Method. Travel time was secured by merely walking through the area. Pulling time was secured by a recorder using a stop watch and

timing the actual pulling operations of one man throughout the day.

3. Conclusions. See Plate VII. The relation of these three operations in crew work is shown on the chart. The outstanding feature is that in the four types of areas, the searching time was more than 60% of the total. In using the results of this experiment as an aid in the study for further reductions in eradication costs, the facts indicate that such reduction must come in the searching time. The normal travel time for an area represents an irreducible minimum for an adequate efficiency. The pulling time, ranging from 100 to 300 Ribes per hour also represents a speed upon which there is not much room for improvement. Practically all the bushes are pulled faster by hand without the aid of a tool. (Another experiment shows the extent which the army trench pick is used.) Consequently, with travel time and pulling time at their lowest, reduction in costs must come in the reduction of searching time. The minimum for searching time would be its virtual elimination except for that which could be done while walking over an area. In other words the lowest cost for an area would be the man hours spent in walking over an area plus the time for pulling the Ribes. Experiments can be run to reduce searching time and determine the efficiency relative to the amount of searching time. Searching time has been reduced by using smaller crews and by the elimination of the foreman from behind the crew line. The results of the experiment on uphill, downhill and contour work indicate that searching time may be reduced by eliminating contour work.

Experiment No. 8. Elimination of Foreman From Behind the Crew Line

1. Purpose. To eliminate the use of a foreman from behind the crew line and to work out a method of checking to replace him.

2. Method. The foreman replaced a man in the line making either a three or four-man crew with no checker behind. The foreman did all his supervision from the line and pulled Ribes just as the other men in the crew. A checker went over the crew strips several days after the crews had performed the work. A final close re-check was made on all strips.

3. Experiment

33 crew days work checked.
92 acres - average 430 Ribes per acre.
9 different crews checked.
5 different checkers used.
Types - Stream, Open Reproduction, Open Mature
Eradication Classes - C and D.

TABLE NO. 2

RESULTS OF EXPERIMENT WHERE FOREMAN WORKED IN LINE AND CHECKING WAS DONE AFTERWARD BY ONE MAN CREW.

Size of Crew Checked	No. of Crew Days	No. of Acres	Crew Work			Checker's Work								
									Ribes Pulled by Checker				Ribes Missed by Checker	
			Man Hours Per Acre	Ribes Per Acre	Per Cent Efficiency	Man Hours Per Crew Day	Man Hours Per Acre	Final Per Cent Efficiency	Per Cent of Bush	Per Cent of L.S.	No. Per Acre	L.S. Per Bush	No. Per Acre	L.S. Per Bush
3-man Crew		2.9	25	1,774	94.0	1.0	1.0	97.3	56.6	65.2	60		48	2
3-man Crew	12	27.2	10.6	407	96.8	1.7	0.7	99.0	67.1	73.6	9	4	4	3
4-man Crew	7	28.3	8.0	372	93.7	0.7	0.2	96.0	36.9	63.7	9	13	15	4
4-man Crew	11	33.6	10.5	381	95.0	1.9	0.6	97.7	54.8	60.8	10	5	9	4

Note: 1. Of the Ribes missed by the checker, 50% of the bushes were suppressed.

2. A recheck on three crew days work with the foreman checking behind his crew showed that he pulled 35% of the bushes missed. There were three men in line on this crew.

4. Conclusions. This experiment gives results of checking on two sizes of crews, with the checking performed at a normal rate and at a fast rate.

a. In the case of a three-man crew, one man can check from 6 to 7 crew days' work in one day getting 56% of the missed Ribes and 65% of the missed live stem. A checker by doing his work more carefully and covering only 4 crew days' work in a day will get approximately 67% of the missed Ribes and 73% of the missed live stem.

b. In the case of a four-man crew, one man can check from 6 to 8 crew days' work in one day getting 37% of the missed Ribes and 63% of the missed live stem. A checker by doing his work more carefully and checking about 4 crew days' work in a day will get approximately 55% of the missed Ribes and 61% of the live stem.

To those unfamiliar with the work, it would seem impossible for one man to go over as many as 8 days of crew work in one day. However, as shown in another experiment (see Plate VII), the travel time, outside of scout work, amounted to only 10% to 14% of the crew time. This travel time represents a normal rate which would permit the traveler to look for Ribes as he walked. Consequently in the light of these facts it would be possible for a man to check 7 to 8 crew days' work in a day.

It is very seldom that a foreman behind the line pulls as many bushes as a man in the line, generally but few, in comparison. With the foreman in the line a man day is saved and trial proved that better supervision could be done from the line. Also a human factor enters in which is the favorable reaction of the men toward a foreman working with them, which will incite men to a better effort, at the same time taking away the inherent dislike to have a man checking behind them. This slows up a crew and makes it overcautious. While in the line the foreman is able to observe the work of the men beside him.

Results show that a crew without a checker behind obtained a fair degree of efficiency. A checker going over the strips after they have been worked by the crew is not held up by the movements of the crew and consequently he is able to cover from three to eight crew days' work in one day of checking, while a foreman checks only one day's work. This checker is able to find more of the missed Ribes than the foreman in the old method because he is able to concentrate his time where misses are numerous and also the bushes pulled by the crew have had time to die and do not conceal or interfere with one's search for missed Ribes.

It is conclusive that there is no need of a man checking behind a crew. Whether the efficiency of such a crew is high enough to dispense with any checking is a point to be decided. The results show that the efficiency can be raised considerably with a checker going over the crew

strips. To cover the entire area worked by the regular eradication crews in a camp, it would take the full time of one capable man, and part time of a second man. Such checking would not only raise the efficiency of the work, but would also insure against any very poor work. It would also provide a check upon the amount of work done by a crew each day, and insure a full day's output from each crew.

In hand eradication work, this method of checking could replace the checking as now being done and in place of 2% of the area being given, a thorough check, the entire area could be checked and more than 50% of the misses pulled, at approximately the same cost. The final efficiency for the area would be determined from the number of Ribes found by the checker.

Experiment No. 9. Use of the Trench Pick in Hand Eradication Crews.

1. Purpose. To determine the extent which a tool is used in hand eradication, and the practicability of the hand trench pick for this work.

2. Method. A recorder accompanied the crews, counting the number of times each man on the crew used the pick (one pick to a crew) and the number of Ribes pulled by each man.

3. Results. Size of experiment.
Check on 13 crew days' work.
Total number of Ribes pulled - 12,977.
Number of Ribes on which pick was used - 165.
Pick used on 1 Ribes out of 78.

The man carrying the pick used it on an average of 5 times a day, while the other men on the crew used it 3 times a day.

4. Conclusions. In the eradication of R. lacustre, R. viscosissimum, and G. inermis in northern Idaho, the bushes are pulled principally by hand, but occasionally some bushes are firmly set and a tool is necessary to get them out. The use of a tool saves from one to thirty minutes on such bushes. Since a tool is used so few times any tool suitable for digging and cutting of roots is adequate. The army trench pick proves very satisfactory. Generally one pick for a crew is sufficient to meet the emergencies, and all crews should be so supplied. In case of bad concentrations of Ribes, the crew foreman will know if additional picks could be used to advantage.

Experiment No. 10. Scouting Crews.

1. Purpose. To make a study on the rate which scout crews should travel.

2. Method. A three-man scout crew was run over strips at various speeds and various numbers of times. Width of crew strip 1½ chains. Size of area - 36 acres. Total area covered - 108 acres.

3. Conclusions: The variables in this experiment were impossible to eliminate. Only generalizations can be made from the data secured, and an experienced scout foreman must determine the rate of travel and width of interval by the conditions of the area.

The rate of travel can be speeded up to some extent, but only on areas that are known to be relatively free from Ribes can that speed be made greater than normal travel time. Where there are 15 to 100 Ribes per acre, to obtain an efficiency above 75%, the rate of travel must not be faster than the normal travel time.

Results on efficiency showed that on the first working of an area that the bushes pulled averaged 11 feet of live stem per bush, while the bushes missed averaged 4 feet of live stem per bush. This shows that a scout crew gets the most dominant bushes on the area. In subsequent reworkings of the strips, the average sizes of bushes pulled and bushes missed were the same. This would indicate that the bushes missed on the original working were missed not on account of size but on account of invisibility to the scouts.

The efficiency on the subsequent reworkings was very low, averaging 34% bushes and 36% on live stem.

V. Recommendations for Future Work.

1. Re-employ for eradication crew work only such experienced men who have shown up well.

2. Use the three-man crew on all areas, except where it is obviously a one or two-man job.

3. Crews repeatedly cautioned against leaving bushes partly pulled.

4. A large scale experiment comparing the cost and efficiency of work performed uphill, downhill and on the contour.

5. The accuracy of the crew count of Ribes pulled warrants a continuation of taking this data.

6. No checker behind the crew line in eradication work.

7. A 100% check of the area worked, by the method described in Experiment 8, in place of the checking now being done.

8. Continuation of the use of the hand trench pick.

CHECKING EFFICIENCY OF HAND PULLING METHODS OF ERADICATION IN NORTH IDAHO

By

P. S. Simcoe, Jr. Forester

INTRODUCTION

Throughout the progress of experimental Ribes eradication in north Idaho it has been necessary to employ a sampling method of inspecting work done, partially for the purpose of determining the degree of protection being afforded, and otherwise to show the results of experiments with hand eradication methods.

All checking in the past has necessarily been more intensive and more costly than any such work need be, in the future, for practical control of blister rust. Since the change from experimental to practical eradication is taking place, and since we are now concerning ourselves more with what is left on the area than with what is being removed, the intensive and costly method of stripping the area must give way to a systematic method of random checking. With this in mind the first random checking was attempted in 1928.

The intensive checking was of the advance strip method this season. Having been run in advance of eradication the strips served as bases for the elimination of low concentration areas, and for advance study of strips to be checked after eradication in heavier concentrations.

I. Purpose of Checking

Checking was organized for the purpose of sampling all eradication work (excluding re-eradication methods and chemical work) in northern Idaho.

II. Methods of Work Employed

In the Coeur d'Alene region the methods were quite similar to those of 1927 while at the Big Creek Camp in the Kaniksu Forest a random method was developed.

The advance strip was used in all checking in the Coeur d'Alene Forest. This consisted of two steps; the running of strips through areas to be worked, and the checking of these strips following eradication. These strips followed compass courses, and were one-half rod wide in all types except stream type, being one rod wide there. These strips were at approximately right angles to the drainages in all cases. One man per strip was used on the narrower strips, and two

men were used on the stream type work. The data contained figures on number of bushes and feet of live stem by species. These strips were ten chains apart on the upland work and twelve and one-half chains on streams. Since this work was done prior to eradication, and since the checkers could get a fair idea of all the country to be protected, the figures taken on the advance check were turned over to the camp bosses to be used as pre-eradication data. This assisted in the location of concentrations of Ribes and eradication types to be worked as well as in the elimination of other areas within the project. Following eradication the strips were checked and figures on number of bushes and feet of live stem missed were collected. Assurance that the check would cover the same ground as the advance check was obtained, as in 1927, by having the compass men mark on trees and other objects along their strips with red timber crayon. The end of each two-chain transect was permanently marked by having a piece of metallic ribbon placed there in a conspicuous place.

The random method used at the Big Creek Camp in the Kaniksu Forest was primarily an attempt to inspect the eradication work by a random coverage of the blocks. This method was used in checking all work at this camp except stream and meadow types, which were checked by two-man crews running rod-wide strips, twelve and one-half chains apart, and at right angles to the flow. This gave us reliable figures on the number of bushes and feet of live stem missed per acre. Then this figure was used as a basis in setting up the maximum allowable for each species (R. lacustre and R. viscosissimum) on the hillsides. The maximum for R. lacustre was set at ten per cent higher than the per-acre figure of all species missed in stream type (222 feet of live stem), and that for R. viscosissimum was arbitrarily placed at 100 feet.

Men having thorough knowledge of Ribes habits and requirements were used in random checking. These men were instructed to look for places where the missed bushes and live stem would exceed the respective maxima. Their familiarity with Ribes helped them in their search for these places. The search took them over practically the whole of the blocks, and any places where observations were made were recorded and located on maps. The high per cent of coverage was due to the fact that there were many small areas, within the blocks, which might have had original concentrations of such size that the proportions of missed Ribes would be large enough to exceed the maxima.

Care was taken in sampling the concentrations of missed Ribes especially where the maxima were approached. This was shown by the method of making estimates. The per-acre figures were not the products of single, or too few, small plots, but were figured on the basis of several series of plots. These plots were one-sixtieth acre in size, and were always laid out in such a way that they were uniformly spaced and located following a plot-series system. Each series con-

tained one-tenth acre. The judgment of the checker was relied on also so that the establishment of these plot series did not become toomechanical. Where the maxima were not approached the establishment of plot series was not considered necessary, but care was taken to avoid letting single missed bushes, or concentrations, be the indicator of the per-acre content.

III. Work Performed

In the Coeur d'Alene Forest 9,340 acres were checked or pre-eradicated, and in the Kaniksu Forest at the Big Creek Camp 8, 457 acres were checked, the stream type in all cases approaching 5% of the total acreage.

Other checking work consisted of checks on the checkers. Three-man crews re-checked parts of the work done by the regular checking crew. These re-check crews followed the red crayon marks left from the checking work, and checked 100% of each re-check strip. A measuring stick was used to give assurance that full strips, one rod wide, were being covered. Brush and any other hindrance to visibility was removed. Although our time did not permit many of these studies, we did get some idea of what efficiency the checkers were maintaining.

IV. Results Obtained

TABLE NO. 1

SUMMARY OF CHECKING DATA - 1928

Camp No.	Type	Bushes Per Acre		Live Stem Per Acre		Per Cent of Type	Average Size Bush		Efficiency of Eradication Based On	
		Pulled	Missed	Pulled	Missed	Checked	Pulled	Missed	No. of Bushes	Ft. of L. S.
#1 Picnic Creek	Cut-Over	35	20	696	104	1.25	19.9	5.2	64	87
#1 Picnic Creek	Stream	153	43	2,249	278	2.00	14.7	6.5	78	89
#1 Little Creek	Cut-Over	221	99	4,707	297	1.25	21.3	3.0	63	96
#1 Little Creek	Stream	339	90	[illegible]	375	2.00	8.9	4.2	79	89
#2 Marie Creek	All Types Except Stream	41	20	746	142	1.25	18.2	7.1	67	84
#2 Marie Creek	Stream	216	54	5,301	279	2.00	24.5	5.2	80	95
Big Creek	All Types Except Stream	-	15	-	38	Random check	-	2.5	-	-
Big Creek	Stream	-	89	-	222	Random check	-	2.5	-	-

TABLE NO. 2

DATA ON ELIMINATED AREAS WITHIN THE PROJECTS

Camp	Bushes Per Acre	Live Stem Per Acre	Average L.S. Per Bush
#1 Picnic Creek	4.7	65.1	13.8
#1 Little Creek	7.7	[illegible]	7.3
#2 Marie Creek	1.7	22.7	[illegible]

TABLE NO. 3

CHECK ON CHECKERS - 1928

Strip No. ____ Location No. ____ Names of Checkers	Number of Bushes Missed		Feet of Missed Live Stem		Average Live Stem Per Missed Bush		Average Height of Missed Bushes		Efficiency of Checkers Based On Percentage	
	Found by Checkers	Missed by Checkers	Found by Checkers	Missed by Checkers	Found by Checkers	Missed by Checkers	Found by Checkers	Missed by Checkers	No. of Bushes	Ft. of L. S.
#b (Area 0.20 acre) Barney Cr.- Camp #1 Orral Luke-Virgil Evans Bushes 6" and over in Ht.	15	28	379	136	23.7'	4.9'	2.1'	0.84'	35%	73
All bushes found	15	43	379	205	23.7'	4.8'	2.1'	0.65'	26	65
#b (Area 0.05 acre) Little No.Fk.C.d'A.River Camp #1 Orral Luke-Virgil Evans Bushes 6" and over in Ht	3	1	15	3.0	5.0'	3.0'	1.3'	2.60'	75	83
All bushes found	3	3	15	4.6	5.0'	1.5'	1.3'	1.00'	50	77
#e (Area 0.10 acre) Marie Creek-Camp #2 J. Thaanum-F. Simcoe Bushes 6" and over in Ht.	4	1	7.5	5.5	1.9'	5.5'	1.2'	0.50'	80	58
All bushes found	4	3	7.5	6.4	1.9'	2.1'	1.2'	0.28'	57	54
	7.3	10.0	134.0	48.2	10.2'	4.5'	1.5'	1.31'	63	71
Average for all strips	7.3	16.0	134.0	72.0	10.2'	2.8'	1.5'	0.64'	38	65
	3.5	1.0	11.3	4.3	3.5'	4.3'	1.3'	1.55'	78	71
Average for last 2 "	3.5	3.0	11.3	5.5	3.5'	1.8'	1.3'	0.64'	54	66

Ordinarily only the bushes which are 6" or more in height are checked against the eradicators.

The upper figures for each strip show the findings based on bushes 6" and over in height.

The strip at Barney Creek was through G. inermis and R. lacustre concentrations, and several long branches of G. inermis were found in the debris.

The other two strips were through light concentrations of R. lacustre. In all three cases there were bushes which had been considered outside of the strips both on the advance check and on the final checks.

TABLE NO. 4

COST STATEMENT

Camp	Checking	Pre-eradication
#1 Picnic Creek	$.096 per acre	$.174 per acre
#1 Little Creek	.257 " "	.127 " "
#2 Marie Creek	.129 " "	.080 " "
Big Creek	.036 " "	. -

The differences in the checking costs at the Coeur d'Alene Camps (#1 and #2) are due to the fact that the cost of checking stream was a great deal higher than the cost of checking cut-over type, and unless there was enough cut-over to bring the average down a high cost resulted.

Future checking methods should be less intensive and costly than in the past, and should give the desired data in conformity with the protection program being followed.

Since future eradication will be done on areas of relatively high concentrations only, and since the work will be of a practical nature, any checking method should resemble some random inspection system. Such a system should furnish the desired data at low cost, because no costly strips need be established or checked. Figures on number of bushes and feet of live stem missed will be all that will be desired. One or two trained checkers would simply inspect the finished work, and judge whether the work would be effective in controlling the local spread of blister rust.

Figures on the maximum of missed bushes allowable for each specie, type or recognized condition should be furnished the inspectors for their use in a random system. With this data the inspectors would have to search for the various maxima, and grade all work according to the amount of missed bushes missed in reference to the amount allowable.

RE-ERADICATION OF RIBES IN NORTH IDAHO

Field Work and Summary by C. O. Peterson
Computations and Report by Anderson and Strong

Introduction

The effectiveness of destroying currants and gooseberries in and near a stand of white pine timber as protection to that timber against white pine blister rust is measured entirely by the Ribes missed and those which reproduce following eradication. Absolute destruction of all Ribes within the protective zone gives complete protection to the timber for which eradication is designed. However, absolute destruction of all Ribes on any given area with one working is not feasible. Such a thing might be done but the resultant cost would be prohibitive.

It is known that on streams and rocky places where many Ribes were growing, considerable regeneration of Ribes (both seedlings and sprouts) follows hand eradication within two or three years. So far as we know seedling reproduction can only be accounted for by the disturbance of duff. Throughout the timbered areas Ribes bushes usually occur singly rather than in masses and disturbance is not sufficient to cause much regeneration of Ribes. It appears then that re-eradication need be done only on streams, rock slides and other limited areas where masses of Ribes grow originally.

The ultimate goal in Ribes eradication is to bring about a permanently Ribes-free condition, especially on these areas of massed bushes of the most susceptible species. The sensible and most economical thing to do is to take full advantage of all natural conditions which tend to discourage and eliminate Ribes such as shading due to closing in of stands, etc.

On hand-eradicated areas records show that 85 to 90 per cent of bushes and 95 to 99 per cent of live stem are destroyed by the first working. This gives a high degree of protection. With the Ribes reproduction following eradication there comes a time when it is not safe to delay re-eradication. When this time comes is a problem for re-eradication to determine. Furthermore, knowing what we do of the action of the rust under certain conditions, it is possible by re-eradication studies to determine approximately the degree of protection given a stand by the original and successive eradications.

I. Purpose of Re-eradication

1. To ascertain average costs per acre for first re-eradication of Ribes on various types.

2. To determine on a large scale the approximate protection afforded an area in terms of amount of Ribes left, the species, location of bushes and extent of Ribes reproduction following the original eradication.

3. To determine the effect of disburbance of duff by the original pulling of bushes on future Ribes production.

4. To determine what eradication types are adequately protected by one eradication of Ribes.

II. Location and Description of Area

The area chosen for this work was that upon which original eradication took place in 1926. It embraces parts of Lamb and Binarch drainages on the Kaniksu National Forest in north Idaho. A complete description of the area was included in the 1926 annual report.

With such a small crew as was used in 1928, it was impossible to cover more than about one-third of the area originally eradicated in 1926. The parts worked were as nearly representative of average conditions as could be determined.

III. Methods Used

1. Complete re-eradication of thirteen permanent blocks of varying conditions representative of the entire area but each block containing only one eradication type plus the stream type contained within the block boundaries. Blocks were permanently marked at the corners.

2. Nineteen strips were worked across blocks originally laid out at right angles to the contours. These strips were not all on one block. Those in each block parallel each other at 10 chain intervals and were 1 chain wide by about three-fourths of a mile in length.

3. Several small plots originally laid out in 1926 on which eradication was regularly done and special studies made thereon, were examined in 1928 and data as basis for further studies secured.

4. Several small temporary strips and plots where eradication was done in 1926 were studied for the purpose of securing detailed information on the amount, location, and extent of Ribes reproduction since original eradication.

For re-eradication work the method of procedure and organization of crews was according to the most advanced information secured from past experiments and the same as methods employed in 1928 on other eradication jobs.

The special studies were conducted by the project supervisor with an experienced assistant.

The map accompanying this report shows the location of all plots, strips and blocks and the boundaries of blocks originally worked in 1926.

IV. Results

The results of the work done fall logically into three classifications, namely: (1) progress of re-eradication, (2) results of special studies on Ribes reproduction following the first eradication, and (3) results of special studies on root and crown sprouting following removal of bushes by various methods. There is necessarily some overlapping in these three classifications of results.

1. Progress of Re-eradication.

TABLE NO. 1

RESULTS OF RE-ERADICATION ON AREA ORIGINALLY ERADICATED 1926

Type	Man Days		Total Ribes Pulled				Acres	Ribes
	Laborer	Foreman	R. lac.	R.visc.	G.inerm.	Total	Worked	Per Acre
D.M.	1.55		2			2	36.0	
O.M.	23.87		1,381			1,381	399.0	3.5
D.P.	21.77	.20	658	44	4	706	339.9	2.1
O.P.	180.16	9.20	7,572	7,004	81	14,657	1,591.2	9.2
D.R.	18.67	.38	764	12		776	180.1	4.3
O.R.	6.62		787			787	186.0	4.2
Stream	71.75	4.22	12,673	15	4,559	17,247	92.0	187.4
Total	324.33	14.00	23,837	7,075	4,644	35,556	2,824.2	12.4

Actual progress of the re-eradication crew of 6 men.

TABLE NO. 2

COST OF RE-ERADICATION TWO YEARS AFTER ORIGINAL ERADICATION

Type	Original Erad. - 1926				Re-Eradication - 1928			
	Acreage	No. Ribes Per Acre	Live Stem Per Acre	Cost Per Acre	Acreage	No. Ribes Per Acre	Live Stem Per Acre	Cost Per Acre
D.M.	465.0	2.2		$0.32	36.0	0.05		$ 0.31
O.M.	573.0	10.5		0.69	399.0	3.5		0.47
D.P.	1,612.0	7.2		0.53	339.9	2.1		0.51
O.P.	4,300.9	28.0		0.80	1,591.2	9.2		0.93
D.R.	940.5	16.6		1.13	180.1	4.3		0.83
O.R.	472.0	14.0		0.83	186.0	4.2		0.28
Stream	501.6	434.2		9.87	92.0	187.4		6.49
Total	8,865.0	42.8	300	$1.26	2,824.2	12.6	37.8	$0.94

Of the total 12.6 bushes per acre pulled only 5.7 bushes per acre were missed by original eradication crews. The balance (or 54.9%)

were bushes under 6" which had germinated or sprouted since 1926.

Table No. 2 shows the result of re-eradication as compared to the results of original eradication in 1926. The average cost is $.94 per acre as compared to $1.26 in 1926. It was known at the beginning that certain parts of the area need not be re-eradicated for the purpose or protecting the stand. However, it ~~was decided to actually~~ work all sample areas by the exact method which would be used on the first eradication in order to secure certain data needed for studying the effectiveness of the original job. Had the re-eradication crews confined their efforts to only these areas where re-eradication was needed as a protective measure, the cost of the job would have been greatly reduced. Considering only those areas where re-eradication was necessary, the average cost per acre as applied against the total acreage which was re-eradicated amounted to $.51 per acre.

It will be observed in the table that cost of re-eradication in dense mature, pole and reproduction is practically the same as cost of original eradication. This was to be expected since there were usually very few Ribes at either working.

The cost of re-eradicating open pole was more than original eradication. This is so because considerable of the open pole re-eradicated was on Lower Lamb Creek where Ribes were very numerous in 1926 and cost ran up to $2.35 per acre as compared to $.40 and $.43 per acre on Upper Lamb Creek and Lower Binarch Creek areas, respectively.

The cost of re-eradicating stream type was high because a large part of this type re-eradicated was a flat area along Lamb Creek where a fire ran through in April, 1926. This fire burned most of the Ribes to the ground but did not kill the crowns. When original eradication was done in July and August, 1926, many of these crowns had not yet sent up sprouts and were missed. Consequently, when the area was re-eradicated this season Ribes were practically as numerous on this particular part of stream type as was the case in 1926. In general stream type re-eradication costs were less than half the original eradication costs, excluding the burned over area described above.

TABLE NO. 3

COST ANALYSIS OF 1928 RE-ERADICATION PROJECT

Item	Re-eradication	Special Studies	Total
Salaries	$ 1,641.64	$613.00	$2,254.64
Subsistence	833.75	173.76	1,007.51
Transportation of men	30.00	31.70	61.70
Transportation equipment	23.86	7.50	31.36
Equipment	66.81	22.50	89.31
Miscellaneous supplies	21.00	7.00	28.00
Twine	40.00	5.00	45.00
Total	$2,657.06	$860.46	$3,517.52

The above is a simple cost statement showing the amount expended for each item of expense.

V. Special Studies

There have always been varying opinions regarding the portion of the Ribes bush which must be removed in order to prevent sprouting following eradication. In 1926 two plots were established. One was a Ribes viscosissimum plot on an exposed hillside and the other a R. lacustre plot just at the edge of a swamp. Three methods of destroying the bushes were used. One was to break off all stems just above crowns, The second was to remove the stems and crown leaving the roots intact, but the broken ends exposed. The third method was the same as the second except the broken root ends were covered with earth. All crowns left and spots where bushes were pulled were marked carefully with a stake.

The plots were examined in 1928 and findings are shown in Table No. 4.

TABLE NO. 4

ROOT AND CROWN STUDY BEGUN 1926.
RECHECK JULY 6, 1928.

Method of Removing Bushes Originally	R.visco. Plot Number Bushes Orig.	R.visco. Plot Number Sprouted Back by 1928	R.lacustre Plot Number Bushes Orig.	R.lacustre Plot Number Sprouted Back by 1928
Stems removed - crowns left	10	10	5	4
Stems and crowns removed - roots left exposed	10	0	5	1
Stems and crowns removed - roots covered	10	0	5	0

Although the number of bushes was small the results were practically unanimous in showing sprouting back only where crowns are left. This is definite in the case of R. viscosissimum but indications are that slight root sprouting may be expected of R. lacustre in the wet areas.

These results are of great importance especially when considering removal of numerous large bushes from rocky areas where crowns may easily be removed but where it is practically impossible to remove roots.

VI. Studies in Varying Aged Timber Stands.

Two special studies were conducted in open reproduction, open pole, open mature and dense pole. The plots covered 3.5 acres in one case and 5 acres in another. In both cases plots were narrow and long and crossing the timber stands at right angles to the contour so as to sample all conditions. The results of these studies are shown in Tables 5 and 6. Both of these plots were on areas where many Ribes were pulled in 1926 and these bushes were uniformly distributed.

TABLE NO. 5

CLASSIFICATION OF BUSHES ON 3.5 ACRE STRIP OF OPEN POLE AREA ERADICATED IN 1926.

Classification of Bushes Pulled in 1928	R. lacustre			R. viscosissimum			Total			Dominant			Suppressed		
	Feet L.S.	No. Bushes	Leaf Bear. Stem	Feet L.S.	No. Bushes	Leaf Bear. Stem	Feet L.S.	No. Bushes	Leaf. Bear. Stem	Feet L.S.	No. Bushes	Leaf Bear. Stem	Feet L.S.	No. Bushes	Leaf Bear. Stem
Bushes entirely missed in 1926	.7	1	.5	203.4	83	104.8	204.1	84	105.3	106.6	20	56.3	98.5	64	49.0
Sprouted from crowns left in 1926	2.6	3	2.6	30.6	14	14.1	33.2	17	16.7	16.0	2	8.9	14.6	15	7.8
Sprouted from pulled bushes left in contact with moist material in 1926	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	3.3	4	3.3	234.0	97	118.9	237.3	101	122.0	121.6	22	65.2	113.1	79	56.8

TABLE NO. 6

STUDY OF STRIP CROSSING OPEN REPRODUCTION, DENSE POLE, OPEN POLE, AND OPEN MATURE. HEAVY R. VISCOSISSIMUM AREA ORIGINALLY - AREA 5 ACRES

Classification of Bushes Pulled in 1928	R. lacustre			R. viscosissimum			Total			Dominant		Suppressed	
	Feet L.S.	No. Bushes	No. Leaves	Feet L.S.	No. Bushes	No. Leaves	Feet L.S.	No. Bushes	No. Leaves	No.	L.S.	No.	L.S.
Bushes entirely missed in 1926	61.5	24	487	517.5	157	3,164	579.0	181	3,651	84	301.0	97	278.0
Sprouted from broken crowns since 1926	.3	1	4	18.1	19	169	18.4	20	173	15	10.7	5	7.7
Seedlings	.1	1	3	.8	3	19	.9	4	22	4	.9	-	-
Total	61.9	26	494	536.4	179	3,352	598.3	205	3,846	103	312.6	102	285.7

An analysis of the data shown in Tables No. 5 and 6 leads to the following conclusions:

1. Practically no Ribes reproduction from seed follows eradication in a well stocked stand due to duff disturbance.

2. Ribes missed and Ribes sprouting back were well distributed and groups of bushes were broken up by original eradication.

3. More than half the bushes found in 1928 were suppressed and practically all the large flourishing bushes were pulled by original eradication crews.

On this area the original eradication crew pulled about 200 bushes with 2,200 feet of live stem per acre. Re-eradication resulted in pulling about 20 bushes with 120 feet of live stem per acre.

It appears that on the timbered areas a very high degree of protection is given by one eradication and another may never be needed because the stand is liable to close in and shade out existing bushes before any appreciable amount of damage occurs. This is the conclusion drawn from the above work.

Re-eradication of stream type tells a different story. Here the problem is fundamentally different because of the presence usually of _G. inermis_ or _R. petiolare_ or both. Not only that but conditions on streams are much more favorable to development of blister rust. Ribes growth is usually so heavy that it is practically impossible to so clean out any given area the first time over that as effective control can be secured as is given other types with one working. Even if only as much live stem were left as occurs with these other types at the first working, the control would not be as permanently effective because there are not the natural factors at work discouraging further Ribes development and because the same amount of very susceptible Ribes is more dangerous to leave than of the less susceptible ones.

Two stream type plots were worked. The area shown in Table No. 7 had originally about ten times as many bushes and more than twenty times as much live stem. The area shown in Table No. 8 was one having originally a mass of _G. inermis_ and _R. lacustre._ In April, 1926 a fire burned over the area, the fire being fed largely by dry grass which had ripened the previous fall. As a result many of the Ribes bushes were burned off at the ground surface and had not sprouted yet when eradication took place in June and July of the same year. Hence the results are not representative of a good eradication job but the data secured helps to understand the factors at work reproducing Ribes under that particular set of conditions.

TABLE NO. 8

DATA ON SPECIAL PLOT STUDY. AREA OF HEAVY G.INERMIS AND R. LACUSTRE ON FLAT ALONG STREAM BURNED OVER CLEAN IN APRIL 1926 ERADICATED IN JULY 1926 BY HAND PULLING CREW. AREA OF PLOT 7.5 ACRES

Classification of Bushes	No. G.iner.	No. R.lac.	Seedlings 1926	1927	1928	Total L.S.	No. Bushes
Sprouts from crowns from which all stems were burned	168	5					173
Sprouts from parts of crown left in ground in 1926 by hand pullers	158	15					173
Bushes missed in 1926	181	6					187
Seedlings germinated since original eradication, 1926			36	363	89		488
Sprouts from bush pulled but left in contact with moist soil	37	2					39
Total all classes	544	28	36	363	89	4,281	1,060

The only logical conclusion which can be drawn from the result shown is that re-eradication is necessary in stream type. There are no natural factors discouraging the Ribes regeneration which follow the first eradication. There is usually considerable sprouting from some of the crowns missed by first eradication and the soil is so thoroughly torn up that much reproduction from seed occurs. Re-eradication should take place before regenerated Ribes are old enough to produce viable seed.

Ribes reproduction following removal of large R. lacustre bushes on rock piles.

Usually at the edges (especially lower edge) of rock slides there occur many large flourishing *R. lacustre* bushes. These rock slides do not support trees or other vegetation and there is an opening in the forest canopy. At the edges there is an accumulation of moss and decaying debris favorable to growth of Ribes and other vegetation. On one such plot in 1926 the exact locations of 100 large bushes were marked with paint on rocks. Regular eradication crews covered the area. Two rechecks were made during the past season, 1928. The following table shows the results of the rechecks:

TABLE NO. 7

CLASSIFICATION OF BUSHES ON 1.25 ACRES OF STREAM TYPE AREA ERADICATED IN 1926

Classification of Bushes Pulled in 1928	R. lacustre			R. viscosissimum			Total			Dominant		Suppressed	
	Feet L.S.	Number Bushes	Number Leaves	Feet L.S.	Number Bushes	Number Leaves	Feet L.S.	Number Bushes	Number Leaves	Number Bushes	Feet L.S.	Number Bushes	Feet L.S.
Bushes entirely missed in 1926	244.0	22	923	120	4	528	364.0	26	1,451	22	359.0	4	5.0
Sprouted from broken crowns since 1926	8.0	3	33	-	-	-	8.4	3	33	2	8.0	1	0.4
Sprouted from pulled bushes left in contact with moist material in 1926	35.7	11	132	-	-	-	35.7	11	132	3	7.7	8	28.0
Total	287.7	35	1,088	120	4	528	408.1	40	1,616	27	274.7	13	33.4

Seedlings pulled which had germinated in 1927 - 10
Seedlings pulled which had germinated in 1928 - 513

TABLE NO. 9

STUDY OF RIBES REGENERATION AFTER ERADICATION OF A DENSE CONCENTRATION OF R. LACUSTRE ALONG THE EDGE OF A ROCK SLIDE ON LOWER BINARCH CREEK

Shade Conditions	Bushes Pulled 1926		Seedlings First Count July 5, 1928		Seedlings Counted Aug 22, 1928		Mortality	
	No. Bushes	Feet L.S.	1927 Seed-lings	1928 Seed-lings	1927 Seed-lings	1928 Seed-lings	1927 Seed-lings	1928 Seed-lings
Open - No shade	64	1,499	494	1,706	397	1,510	97	196
Partial Shade	22	407	112	175	60	197	52	?
Heavy Shade	14	280	4	17	7	10	?	7
Total	100	2,186	610	1,898	464	1,717	149	203

No bushes or crowns were missed by original eradication crews. It will be noted that heavy seedling reproduction follows due to the disturbance and the fact that heavy crops of seeds occur on such areas each year. Good light and plenty of moisture are important factors.

In the case of the partial shade class more 1928 seedlings were counted on August 22 than on July 5. Some germination was taking place at the time of the July 5 check and undoubtedly some 1928 seedlings were missed on this count. In the case of the heavy shade class seven 1927 seedlings were counted on August 22 and only four on July 5. There was evidently an error here in determining year of germination or seedlings missed on the original count.

In the period of slightly more than a month and a half there was a mortality of 352 seedlings.

Such heavy reproduction occurs on these rock slides that it may be more practical to destroy bushes originally by toxic sprays.

Table No. 10 shows the results of a similar study on Upper Binarch Creek except that sites of old bushes were not marked. Here the results are similar except some sprouting resulted.

TABLE NO. 10.

RESULT OF STUDY ON ROCKY SITE AT FOOT OF CLIFFS
UPPER BINARCH CREEK

Soil Conditions	Number Seedlings		Crown Sprouts		Missed Bushes		Total No. Bushes
	1927	1928	No.	L.S.	No.	L.S.	1928
Soil disturbed by pulling bushes 1926	147	94	2	2.8	-	-	243
Soil not disturbed by pulling bushes 1926	21	29	-	-	3	3.5	53
Total	168	123	2	2.8	3	3.5	296

Area - 1/100 of an acre
Site - Rocky outcrop at edge of stream type and at bottom of precipitous slope.
Soil conditions-much moss and drying duff.
Heavy concentrations of large R. lacustre bushes pulled from area in 1926. Bushes so large as to require use of miners' picks to pry roots from rocks.

PRE-ERADICATION SURVEY OF STREAM TYPE
CLEARWATER NATIONAL FOREST, 1928

By

C. C. Strong, Assistant Forester

At a conference in August 1928, between representatives of the Western Office of Blister Rust Control and District 1 of the Forest Service, a decision was reached to begin the destruction of Ribes for control of white pine blister rust on the southernmost National Forest white pine areas as soon as funds were provided. It was further agreed that such work should for the present be confined to the narrow strip of land along streams commonly known as "stream type" and that such work be gotten under way as quickly as possible in order to eliminate extensive damage to white pine stands which would otherwise inevitably come.

Several factors were considered good and sufficient reasons for deciding upon this plan. Of the four species of wild Ribes commonly found in this region, two of them are found only in stream type. These two species, Grossularia inermis and Ribes petiolare, are by far the most dangerous alternate hosts of the rust and represent potential damaging power to white pine many times greater than the other two species of Ribes. Of these two most susceptible Ribes species, R. petiolare is far more dangerous than G. inermis. R. petiolare reaches its maximum development toward the southern limit of white pine type. R. lacustre is the least susceptible of the four species. However, it commonly occurs in dense masses and attains its greatest development along streams and in other moist places under which condition it will also be dangerous. The fourth species, R. viscosissimum, is a dry site bush and seldom is found on stream type. It will thus be seen that stream type, with its masses of dangerous Ribes, needs first attention. It has been conservatively estimated that stream type Ribes represent 75% of the potential damaging power to white pine timber from the rust.

During the past summer most of the rust found on Ribes was on R. petiolare in this southern belt. It was in a most vigorous form, indicating that great damage in that area will result if no control measures are undertaken.

Another factor influencing the decision is the present stage of development of Ribes destruction by application of toxic chemicals. R. petiolare is readily killed by applying sprays of sodium chlorate ($NaClO_3$) in varying concentrations. G. inermis has proven a more difficult problem. Research is under way which will undoubtedly result in finding a chemical which will prove successful as a toxic spray on G. inermis. Hence the decision to begin for the present at the southern edge of white pine where R. petiolare prevails.

Since definite steps had been taken to secure appropriations for instituting local control of blister rust on National Forest lands in 1929, it was necessary to conduct a preliminary survey of stream type on the area to be worked. The Musselshell district of the Clearwater National Forest was chosen.

I. Purpose for Which Work Was Done

1. To obtain such information on the area as is necessary for planning the field organization and method of procedure when funds are available to do the work.

2. To obtain information on which to base an estimate of the type and amount of spraying equipment necessary and the amount of equipment and chemicals required on the given area.

3. To obtain information from which to construct a base map for use by the various supervisors of the work.

II. Location and Description of the Area

The area upon which this preliminary survey was conducted constitutes approximately 90,000 acres of the Musselshell district of the Clearwater National Forest. It lies entirely within Townships 33, 34, 35 and 36 North, Ranges 6 and 7 East of the Boise Principal Meridian. It is practically at the southern edge of commercial white pine stands of timber.

In general the area is characterized by very valuable white pine stands much of which is in the late reproduction, pole and mature stage.

There are four main drainages: the Musselshell, Lolo, El Dorado, and Orofino. Then there is the usual network of tributaries. Since the area is more or less of a plateau type with gentle slopes and no very great variations in elevation, streams are not generally of the rapidly flowing class. Hence the stream type is often unusually wide and densely populated with Ribes. Perhaps in few other regions would such a large proportion of total Ribes present be confined to the stream type. On the other hand, there are few other areas where the total volume of Ribes would be greater than on this Musselshell area.

III. Procedure and Methods

1. Pre-eradication survey - The work was done in the latter part of September, 1928, while the Ribes were still in sufficient leaf to permit accurate ocular estimates. Pre-eradication was confined entirely to stream type.

There are certain portions of any stream type and very frequently entire stream drainages which are adapted to hand pulling. This is generally true of most rapidly flowing streams and many small tributaries. Then there are other stream areas, especially along the more or less meandering streams, where Ribes grow in such profusion as to make them particularly adapted to spraying with toxic chemicals. Consequently, it was the purpose of the pre-eradication crew to class all stream type areas into one of the two general divisions. However, such a general classification is not sufficient for the purposes intended and it was necessary to further divide each general division into three classes representing light, medium or heavy hand pulling and light, medium or heavy spraying work. The three hand pulling classes are henceforth called B, C, and D and the three spraying classes L, M, and H.

Roughly, the various classes are represented by conditions shown in the following table:

TABLE NO. 1.

Class	Average No. Ribes Found Per Acre For Class	Average Percentage Ribes Concentration For Class	Acres One Man Will Cover In 8-Hour Day	Average Amount of Sodium Chlorate Necessary Per Acre	Method of Working
B	1 - 40		1.0-2.0 acres	None	Hand
C	41 - 350		0.5-1.0 "	None	"
D	351 up		0.2-0.5 "	None	"
L		1-4% density	1.0-up "	50#	Chemical
M		5-24% "	0.5-1.0 "	125#	"
H		25% up "	0.2-0.5 "	225#	"

The method ordinarily used was a complete examination of all stream type with the exception of some of the small tributaries. Here it was decided that examination of a few tributaries would give average conditions for all tributaries since these small streams do not vary much in Ribes conditions.

In conducting the pre-eradication survey, men working individually will cover nearly as much area as two men working together. Consequently men usually worked alone. In a few cases where stream type was pretty uniformly two or three chains in width, a two-man crew was used with one man on either side of the stream.

On narrow streams one man following the course of the stream (pacing for distance and tieing in to known locations wherever possible) was able to classify conditions as he walked. Where stream type was too wide to permit proper classification by this method it was necessary to use the offset method. By the offset method the man crosses the stream every 2-1/2 or 3 chains to permit a better ocular examination and obtain the width of stream type.

Each man did his mapping roughly to scale as he worked in the field and then transferred his field data to a base map whenever he had an opportunity to tie-in to a known location. Usually sufficient tie-ins were made each day to enable transferring field data to base map each night. Since the map of the Clearwater Forest seems to be very accurate, little difficulty was found in correlating field data.

2. Control reconnaissance - In making the pre-eradication survey, full advantage was taken of the data secured by reconnaissance crews. Pre-eradication data were further substantiated by reconnaissance data on stream type. Pre-eradication estimates on many small tributaries were also substantiated by reconnaissance data.

On the pre-eradication survey no effort was made to duplicate the work of reconnaissance crews and Forest Service relative to composition of timber stands in the Musselshell Ranger District. On the map which accompanies this report the timber data were secured from control reconnaissance.

IV. Results of Work

Table No. 2 below shows total acreage by eradication classes found by pre-eradication and reconnaissance crews to exist on the area.

TABLE NO. 2.

Hand Pulling Classes	Acreage	Spraying Classes	Acreage
B	1,290	L	287
C	1,307	M	290
D	376	H	60
Total	2,973	Total	637

Total acreage all classes - 3610.

V. Estimate of Chemicals Necessary and Cost of Stream Type Eradication.

TABLE NO. 3

Eradication Class	Acreage	Amt. $NaClO_3$ Needed	Estimated Cost Per Acre	Total Estimated Cost
B	1,290	None	$ 5.00	$ 6,450.00
C	1,307	None	10.00	13,070.00
D	376	None	20.00	7,520.00
L	287	10 Tons	25.00	7,175.00
M	290	19 "	40.00	11,600.00
H	60	10 "	75.00	4,500.00
All	3,610	39 "	$13.94	$50,315.00

Eradication of Ribes from the stream type will give a very high degree of protection to the entire area drained by these streams or approximately 90,000 acres. However, only about one-half of the area can be classed as white pine type now. The balance is either classed as having species other than white pine or as brush.

It is certain that much of this non-white pine acreage is good white pine site and may be considered as potential for the purpose of growing white pine. This is a matter for the Forest Service to decide. The existing white pine type is so situated as to make necessary eradication of Ribes from practically all the stream type to give adequate protection to these existing stands. The following table shows acreages of each classification and the average cost per acre for protection when the entire cost is thrown against any one or group of classes.

TABLE NO. 4

Classification of Area	Acreage	Cost Per Acre
Stream type alone	3,610	$13.94
Stream type including white pine type	39,000	1.29
Stream type including white pine and reproduction which may have satisfactory amount of white pine	46,000	1.09
Entire acreage	90,000	.56

V. Conclusion

An allotment of $50,315.00 will permit the employment of the following personnel to conduct the work in addition to the man assigned by the Forest Service to handle the administrative end of the job. The personnel listed will be sufficient to handle the actual field work and the supervisors will be thoroughly trained in hand pulling and chemical methods. In addition a part of the laborers will have had at least one season's experience.

1. - 1 general supervisor of all the field operations.
2. - 5 camp supervisors or bosses.
3. - 1 commissary clerk.
4. - 2 packers.
5. - 1 truck driver (provided we do our own trucking).
6. - 25 crew foremen.
7. - 100 laborers.

Transportation:

2 pack strings (8 pack animals and 1 saddle horse each).
1 truck, 2-ton (provided we do our own hauling).

RIBES ERADICATION ON PRIVATE LANDS BY HAND PULLING METHODS, IDAHO

by

B. A. Anderson, Junior Forester.

INTRODUCTION

The Big Creek eradication program was unique in that it was the first attempt at local control of white pine blister rust by the State of Idaho and private interests. The work was performed in cooperation with the Priest Lake Timber Protective Association and the Office of Blister Rust Control. Heretofore the state has confined its activities to black currant work and control reconnaissance through its membership in the Timber Protective Associations.

By 1928 experimental work in local control of blister rust by hand eradication of Ribes had advanced to such a degree that the control work was on a practical basis for application to the white pine stands of Idaho. The Big Creek area was chosen by private interests and the State Forester of Idaho as the area upon which to carry out the cooperative control program.

In April the area was inspected, Ribes conditions determined, the condition of roads, trails, and camp sites ascertained, and tentative plans for working the area were made.

Maps of the Big Creek and Fox Creek drainages showing streams, burns, camp sites, logging chutes, and cutting operations for the past seven years were secured from the Diamond Match Company. These maps proved of great value in planning the work. The map of the cutting operations was of considerable assistance in interpreting Ribes conditions before hand on various aged cuttings.

I. Purpose

1. Local control of white pine blister rust by hand eradication of Ribes from a given area.

2. Practical application of hand eradication methods on private lands.

3. Development of personnel for future work.

II. Location and Description of Area.

The Big Creek area included the Fox Creek and Big Creek drainages east of the Priest River-Coolin road. The principal part of the area lies within townships 57 and 58 north and ranges 3 and 4 west, Boise principal meridian. Both creeks drain into Priest River. The area is one of the finest white pine sites in northern Idaho.

Practically all of Fox Creek and the slopes north of Big Creek to Diamond Match Camp #2 have been logged over. Above Camp #2 the North Fork of Big Creek has been logged to the Upper Dam in the northeast corner of section 6, township 57 N., range 3 W. Almost all of the cutting has been done within the last nine years. The timber has been cut to a 12-inch D.B.H. limit and the slash piled and burned. As a result of the excellent management plan followed and the site qualities of the area, white pine reproduction is coming in on all cutover land except the lower part of the Fox Creek Drainage which has been burned over and pastured.

There are relatively few steep slopes on about half of the area which lies at an elevation of 2,400 to 6,200 feet. Brush is quite light.

Good truck roads connect Camp #1 on Fox Creek and Camp #2 on Big Creek with the Priest River-Coolin road. A road which is no longer passable by cars connects Camp #1 and Camp #3. Trails make the rest of the area readily accessible from Camp #2.

Two species of currants, Ribes viscosissimum and R. lacustre, and one of gooseberry, Grossularia inermis, were found on the area. Where brush piles have been burned R. viscosissimum is reproducing in rather dense concentrations about the edges of the burns. Dense masses of R. lacustre were found in the seepages at the upper limits of the white pine and about the edges of talus slopes below the Priest River Experiment Station Lookout and the Bald Mountain Lookout.

III. Methods and Equipment

The camp consisted of approximately twenty-five men besides a cook and flunky. About half of the crew were second-year men with the other half getting their first experience in blister rust work. The large proportion of experienced men made it a simple matter to train the inexperienced men. The crews reported for work on June 15th.

The Diamond Match Company kindly gave the blister rust workers permission to use their three camps as quarters. Camp #2 was selected as the main camp because of its central location to the work and excellent living accommodations.

The entire area was scouted for Ribes-free territory and all mature timber containing less than ten R. lacustre per acre was not worked. Seepages on streams containing concentrations of Ribes were located by stripping methods and eradicated.

Strips one-eighth of a chain wide and ten chains apart were run thru the dense mature timber. The strips were run by compass on a due north and south bearing. Ribes data consisting of the number of bushes and the feet of live stem were tabulated for each two-chain transect of the strip. This data showed where the concentrations of Ribes occurred. The crews then worked this portion of the strip.

W. 413. Stream type on Big Creek, Kaniksu National Forest, Idaho. 250 Ribes (G. inermis and R. lacustre) per acre. Clear cut area in background.

W. 418. Stream type, in mature timber stand, Fox Creek, Kaniksu National Forest, Idaho. Numerous Ribes growing through sod, making effective eradication difficult.

W. 424. Area on Fox Creek, Kaniksu National Forest, Idaho, logged under state supervision. 12 inch diameter limit, brush piled and burned. Ribes 125 per acre. Cost to work $.65 per acre.

W. 412. Clear cut logging, followed by repeated burning. Fox Creek, Kaniksu National Forest, Idaho.

Territory that could not be reached in half an hour's walking time from Camp #2 was worked from side camps. Two side camps were used, one on the upper North Fork of Big Creek and one on the Fox Creek Meadow. With the exception of approximately five acres of stream type no work was done on the South Fork of Big Creek.

The men were divided into three and four man crews according to their ability. The better men were placed on scouting crews and used where the type of work required personal initiative, judgment, and where close supervision was impossible. The slower men in charge of a competent foreman were used to eradicate stream type and where the necessary supervision could be given.

Twine was used to mark the strip boundaries.

All staple supplies were purchased from the Forest Service and trucked in from Spokane on the truck operated by the Office of Blister Rust Control. Perishable goods were purchased at Priest River.

IV. Results of Work

TABLE NO. 1

EXPENDITURES - 1928
COST ANALYSIS BIG CREEK CAMP

Items	Cost	Per Cent of Total Cost
Salaries	$5,582.81	61.30
Subsistence	3,006.90	33.01
Transportation men	150.45	1.65
Transportation equipment	76.50	0.84
Equipment	133.38	1.46
Miscellaneous supplies	41.00	0.45
Twine	117.00	1.29
Total	$9,108.04	100.00

Table No. 1, principal items of expense of the Big Creek Camp with the percentage of each in relation to the total cost of the project.

TABLE NO. 2
SUMMARY OF ERADICATION DATA ACCORDING TO CLASSES
BIG CREEK CAMP - 1928.

Class	No. of Ribes by Classes			Total Ribes On Class	Total Acres By Classes	Ribes Per Acre				Man Days				Cost Per Acre
	R.lac.	R.vis.	G.in.			R. lac.	R. vis.	G.iner.	Total	Crewman	Foreman	Scout	Total	
A	11363	1868	196	13427	3957.25	2.87	0.47	.05	3.39	17.5625	30.9375	37.125	85.625	$ .125
B	19482	8617	267	28366	763.00	25.53	11.29	.349	37.17	28.375	35.7500	49.625	113.750	.863
C	147607	137481	3728	288816	3091.00	47.75	44.48	1.207	93.437	331.375	205.3125	223.000	759.6875	1.422
D	106303	82866	58167	47336	646.00	164.555	128.275	90.04	382.87	419.500	145.6875	49.750	614.9375	5.508
Total	284755	230832	62358	577945	8457.25	33.67	27.29	7.37	68.33	796.8125	417.6875	359.500	1574.0000	$1.077

Table No. 2, summarization of Big Creek eradication data according to classes.

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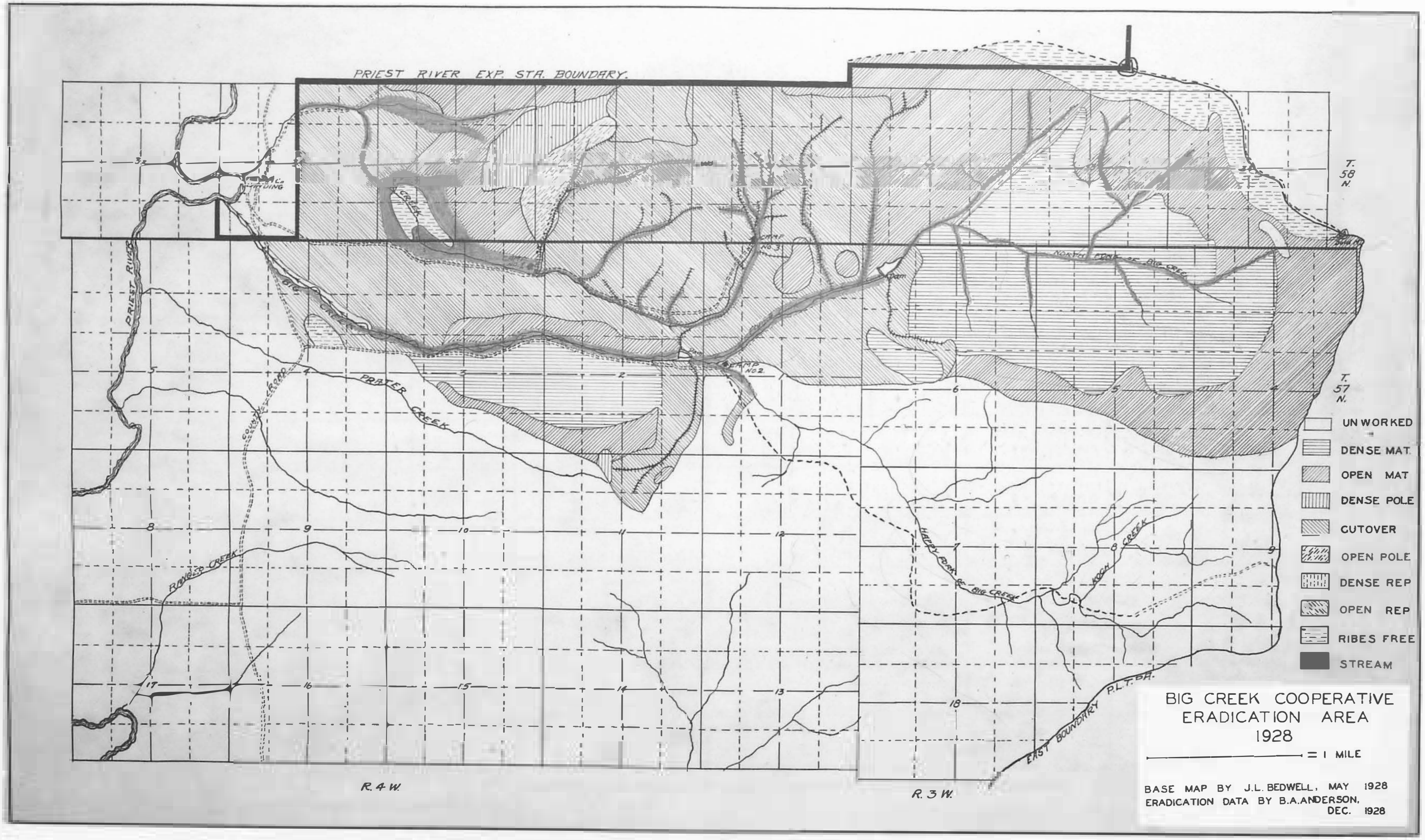

TABLE NO. 3

RESULTS OF WORK DONE BY ERADICATION TYPES
BIG CREEK COOPERATIVE PROJECT, 1928

Type	Number Ribes Pulled				Man Days			Acreage	No. Ribes Per Acre	Cost Per Acre
	R. lac.	R. visco.	G. iner.	Total	Laborer	Foreman	Total			
Dense Mature	17,224	3,678		20,902	77.0000	31.8750	108.8750	1,863.00	11	$0.34
Open Mature	87,171	23,206	1,719	112,096	315.6250	128.3750	444.0000	2,277.00	49	1.13
Dense Pole	1,314	500	61	1,875	9.2500	3.2500	12.5000	196.00	10	0.37
Open Pole	1,302	71	89	1,462	10.1250	3.3750	13.5000	120.00	12	0.62
Dense Reproduction	286	160		446	3.5000	1.2500	4.7500	133.25	3	0.21
Open Reproduction	14			14	.3750	.1250	.5000	3.00	5	0.91
Cutover	131,227	195,067	2,115	328,409	408.0625	146.3750	554.4375	2,737.15	120	1.17
Stream	46,217	8,150	58,374	112,741	332.3750	103.0625	435.4375	399.85	282	6.29
No Ribes - Dense Mature Thrown Out								728.00		
Total	284,755	230,832	62,358	577,945	1,156.3125	417.6875	1,574.0000	8,457.25	68	$1.08

In any timber type such as open mature, stream, etc., there is a large variation of Ribes conditions within the type itself. One tract of open mature timber may be free of Ribes while another open mature tract may have thousands of Ribes. Average eradication costs gathered from several regions for a timber type are very general. A specific cost applicable to one region cannot be applied to another region.

Instead of classifying an area according to timber types which mean very little from an eradication standpoint, it was thought that a classification based on Ribes concentrations would do away with the inconsistencies of the type method. In the class method the area is gone over and classified in five classes: Class A represents the acreage with less than 10 Ribes per acre; Class B., 10 to 40 Ribes per acre; Class C., 41 to 300 Ribes per acre; Class D, over 300 Ribes per acre. An area to be eradicated by chemicals would be represented by Class E.

In Class A work a three-man crew would probably cover 50 to 125 acres per day, in Class B work a three-man crew would probably cover 12 to 50 acres per day; in Class C the same size crew would average 3 to 12 acres per day. In Class D a four-man crew would work approximately from 1 to 3 acres per day.

Besides the number of Ribes per acre, the difficulty of pulling the bushes, density of underbrush, and any factor which would influence the eradication of the bushes is taken into consideration when classifying the area.

For an area thus classified it would be possible to give fairly definite eradication cost figures regardless of what region the area was in.

V. Recommendations for Future Work

1. During the latter part of April an inspection of the Big Creek area was made. The object was to secure all data regarding Ribes conditions, timber types, camp sites, and any information which would facilitate the eradication of the Ribes on the area. On the south slopes Ribes buds had begun to burst about the first of April and from five to fifteen days later on north slopes. On the upper hills at elevations of about 3500 feet, the ground was still covered with snow so that no Ribes data could be secured.

From the observations made at that time it was concluded that the area was relatively free of Ribes. When work commenced in June, however, it was found that our conclusions were not correct. It became evident that only the largest bushes had been conspicuous in the latter part of April and on many of these the buds had probably not burst, thereby making it difficult to locate them. On the upper slopes where no observation had been taken because of the snow, Ribes were found to be present in large concentrations.

It might be feasible to do pre-eradication work about the 1st of June in the Priest River country but on the basis of this data it would be well if at all possible to do pre-eradication work in the fall rather than in the spring.

2. In hand eradication it is very difficult to locate Ribes in stream types after the annual crop of ferns, weeds, etc., have sprung up. A good share of the crew man's time is wasted in searching for Ribes. Where it is possible in the absence of swampy conditions it might be well to eradicate all stream type as soon as possible after the crews have arrived in the field.

3. Three-ply sewing twine was used to mark strip boundaries. If two-ply sewing twine could be secured it would probably be strong enough and besides possess more mileage to the ball. More mileage would be a distinct help to the scouting crews. With the three-ply twine they are forced to carry more than one ball to cover the day's work.

CONTROL RECONNAISSANCE, IDAHO

by

J. L. Bedwell
Assistant Pathologist

I. Definition and Purpose of Work

A rapid and systematic survey of the white pine region to determine:

1. The extent and distribution of white pine types, and
2. The factors influencing the cost and methods of eradicating Ribes thereon.

II. Methods of Work

A. Field Methods:

The areas covered by reconnaissance on the Clearwater National Forest and the three associations were worked by the same standardized methods. Part of each area was worked intensively and part extensively. The intensive areas were typed and plots were taken every ten chains (two to the forty) on a strip run through the center of each forty, whereas the extensive areas were typed only, no plots being taken.

This being the last year of large scale reconnaissance work the proportion of extensive to intensive work was considerably increased. This proportion was much higher on the Clearwater Forest than on the associations due to the greater amount of uniform areas, consisting largely of burns and brush. There were, however, at least eight intensive sections worked in each township having white pine on the Clearwater Forest.

Details of the methods employed are shown in the instructions for performing control reconnaissance contained in the 1927 annual report. A supplementary sheet of instructions, which are modifications of some of the previous instructions, is included in this report. The field map sheets, field data sheets, and field section summary sheets were the same as the copies shown in the 1927 report.

"Supplementary Reconnaissance Instructions"

"The following modifications of the preceding instructions will be observed in future reconnaissane work:

"Plots will be numbered consecutively from 1 to 32 as before, but data will be taken in white pine types only. Ribes data will be

taken in all white pine types but timber data will be taken only in the pole and reproduction stands.

"On stream type plots the Ribes will not be counted but will be designated as Heavy (H), Medium (M), or Light (L), depending upon the brush density and the proportion of that brush represented by Ribes.

"The regular field summary work sheets must be kept up in the field as a part of the work of each section. This is a simple task if progressively performed and no excuse should be given for non-conformance.

"The saving in time in the field by limiting the plot data to white pine types and the elimination of Ribes counts on stream plots will permit of a more accurate typing of stream type both as to width and as to distances that it extends along the streams. More time can be spent in examining small streams and tributaries between strips in order to get a more accurate acreage of stream type on the section."

"J. L. Bedwell
Assistant Pathologist"

"618 Realty Building
Spokane, Washington
May 1, 1928"

1. Differences in methods over those of last year. There were three changes made in the methods as used last year. These changes were (a) No data were taken on plots that were in timber types other than white pine. (b) Timber data were taken in white pine type only in the pole and reproduction stands, not in mature timber. Ribes data were taken on plots in all the white pine age classes as before. (c) On stream type plots the Ribes were not counted but were designated as H (Heavy), M (Medium), or L (Light), depending upon the brush density and the proportion of that brush represented by Ribes.

B. Office Method:

1. Compilation of data. Since 1926 all completed reconnaissance data, reconnaissance maps, and ownership maps have been kept in permanent standardized form in lock type post binders as described in 1927 report.

The ownership maps are corrected for changes up to December 31, 1926.

2. Preparation of permanent reconnaissance maps. The permanent reconnaissance maps are put on township plats, scale 2" = 1 mile, and filed by township and range, together with the corresponding reconnaissance data and ownership map in the post binder mentioned above. A copy of the instructions for the preparation of permanent reconnaissance maps was included in the 1927 annual report.

C. Personnel:

The permanent personnel consisted of the project supervisor, J. L. Bedwell, his assistant, M. C. Riley and five other permanent men, viz: W. F. Painter, in charge of the Clearwater Association crew; G. M. Whiting, in charge of the Coeur d'Alene Association crew; R. E. Myers, in charge of the Potlatch Association crew; H. F. Geil and P. B. Rowe, on the Clearwater National Forest crew. Mr. Riley devoted his entire time to the supervision of the work on the Clearwater National Forest. The project supervisor divided his time between the association crews, the crew on the national forest, and the Big Creek cooperative eradication crew.

The temporary personnel consisted of twenty-five men, employed for the field season only. These men were distributed as follows: Clearwater Association, four; Coeur d'Alene Association, two; Potlatch Association, three; and Clearwater National Forest, sixteen.

D. Training of Temporary Assistants:

At the beginning of the field season training camps were held for the purpose of training the temporary men and to standardize the field methods. The Clearwater Association crew had a training camp near Pierce, Idaho, the Coeur d'Alene Association crew near Clarkia, Idaho, the Potlatch Association crew near Elk River, Idaho, and the Clearwater National Forest crew at Musselshell Ranger Station on the Clearwater Forest.

The crewmen were given the usual work in identification of Ribes and associated shrubs. They were also given a review in the identification of the tree species of the region. Considerable time was spent in instruction of methods and uniformity in taking field data.

III. Work Performed and Results Obtained On Federal Lands

A. General Location of Work:

1. Clearwater National Forest. The entire Clearwater Forest was covered by reconnaissance this year.

2. St. Joe National Forest. That part of the St. Joe Forest located south and east of the Little North Fork of the Clearwater River in Township 41 N Ranges 5 and 6 E. This area is administered by the Clearwater Forest and we have therefore, included it with the Clearwater in this report.

B. Clearwater National Forest.

1. Detailed Location. The entire Forest was covered.

2. Results of Work.

TABLE NO. 1

Acreage and Per Cent of Types Covered
By Reconnaissance, Clearwater
National Forest 1928

Type	Acres	Per Cent
White Pine	206,375	21.77
Stream	9,377	.99
Other Timber	257,574	27.18
Forest Land Not Reproducing		
Brush	421,772	44.49
Burn	25,190	2.66
Non-forested Land		
Rock	5,836	.62
Meadow	2,088	.22
Barren	19,591	2.07
Total	947,803*	100.00

*39957 acres were on St. Joe National Forest.

TABLE NO. 2

Age Classes by Eradication Types
(White Pine Only) Clearwater National Forest
1928

Eradication Type	Age Classes								
	0-10	11-20	21-40	41-60	61-80	81-100	101-200	200+	Total
Dense Mat.						215	250		465
Open Mat.					4,727	49,212	88,242	6,868	149,049
Dense Pole				961	485				1,446
Open Pole			336	6,554	5,650	523			13,063
Dense Rep.		34	1,433	112					1,579
Open Rep.	9,226	7,271	20,948	3,328					40,773
Total	9,226	7,305	22,717	10,955	10,862	49,950	88,492	6,868	206,375

TABLE NO. 3

White Pine AreasCovered by Reconnaissance
Clearwater National Forest
1928

Erad. Type	Extensive	Intensive	Total Acres
Dense Mature	295	170	465
Open Mature	122,741	26,308	149,049
Dense Pole	1,429	17	1,446
Open Pole	11,450	1,613	13,063
Dense Repro.	1,280	299	1,579
Open Repro.	33,706	7,067	40,773
Stream	7,780	1,597	9,377
Total	178,681	37,071	215,752

TABLE NO. 4

Ribes per Acre on White Pine Type Covered by Intensive Reconnaissance, Clearwater National Forest 1928

Eradication Types	Ribes Free Acres	Ribes Present								Total Ribes	Total Acres
			Average No. Ribes per Acre								
		Acres	R. lac.	R. visc.	R. pet.	G. iner.	G. irrig	Total			
Dense Mat.	0	170	3.00	0	0	0	0	3.00		510	170
Open Mat.	5,858	20,450	47.11	6.81	2.06	.49	.25	56.72		1,160,037	26,308
Dense Pole	17	0	0	0	0	0	0	0		0	17
Open Pole	131	1,482	41.45	3.11	.35	0	[illegible]	44.91		66,560	1,613
Dense Rep.	124	175	13.97	13.03	0	0	0	27.00		4,725	299
Open Rep.	903	6,164	47.13	96.91	2.72	0	1.15	147.91		911,679	7,067
Totals & Averages	7,033	28,441	46.36	26.14	2.09	.35	.43	75.37		2,143,511	35,474
Stream	19	1,578									1,597
Grand Total	7,052	30,019									37,071

C. St. Joe. National Forest:

1. Detailed Location. T. 41 N. R. 5 E. Boise Meridian Sections 9-17, 19-36 inclusive. T. 41 N. R. 6 E. Boise Meridian Sections, 1-36 inclusive.

2. Results of Work. Included in tables 1, 2, 3, 4.

IV. Work Performed and Results Obtained on Private Lands

A. General Location of Work:

In 1928 reconnaissance work on private lands was done on three north Idaho timber protective associations, viz: Clearwater T. P. A.; Coeur d'Alene T. P. A.; and Potlatch T. P. A.;

B. Clearwater Timber Protective Association:

1. Detailed Location.

T. 34 N. R. 5 E.	Sections 1 and 2.
T. 35 N. R. 5 E.	Sections 1-3, 10-13, 23-25, 36.
T. 36 N. R. 5 E.	Sections 1, 4-6.
T. 37 N. R. 5 E.	Sections 18-20, 24, 25, 29-36.
T. 37 N. R. 6 E.	Sections 1,2,5-7, 10-24, 28-32.
T. 38 N. R. 4 E.	Sections 4-9, 16-21.
T. 38 N. R. 6 E.	Sections 23-28, 31, 32, 36.
T. 39 N. R. 4 E.	Sections 4,8,9, 16-28, 34-36.
T. 39 N. R. 5 E.	Sections 1-15, 23-26, 34-36.
T. 39 N. R. 6 E.	Sections 1-36.
T. 40 N. R. 5 E.	Sections 1-36.
T. 40 N. R. 6 E.	Sections 1-36.

2. Results of work.

TABLE NO. 5

Acreage and Per Cent of Types
Covered by Reconnaissance, Clearwater T.P.A.
1928

Type	Acres	Per Cent
White Pine	120,758	83.37
Stream	813	.56
Other Timber	20,602	14.22
Forest Land Not Reproducing		
Brush	1,545	1.07
Burn	295	.20
Cutover	480	.33
Non-forested Land		
Cultivated	0	0
Meadow	360	.25
Barren	0	0
Rock	0	0
Total	144,853	100.00

TABLE NO. 6

Age Classes by Eradication Types (White Pine Only) Clearwater Timber Protective Association 1928

Eradication Types	Age Classes								
	0-10	11-20	21-40	41-60	61-80	81-100	101-200	200+	Total
Dense Mat.						1,145	2,195	70	3,410
Open Mat.						1,784	55,990	26,837	84,611
Dense Pole			50	155	200				405
Open Pole			455	835	1,239	1,042			3,571
Dense Rep.		1,067	900	15					1,982
Open Rep.	2,275	15,891	8,613						26,779
Total	2,275	16,958	10,018	1,005	1,439	3,971	58,185	26,907	120,758

TABLE NO. 7

White Pine Area Covered by Reconnaissance Clearwater Timber Protective Association 1928

Eradication Type	Intensive	Extensive	Total Acres
Dense Mature	1,310	2,100	3,410
Open Mature	18,838	65,773	84,611
Dense Pole	25	380	405
Open Pole	270	3,301	3,571
Dense Repro.	445	1,537	1,982
Open Repro.	5,441	21,338	26,779
Stream	261	552	813
Totals	26,590	94,981	121,571

TABLE NO. 8

Ribes per Acre on White Pine Type Covered By Intensive Reconnaissance Clearwater T. P. A. 1928

Eradication Type	Ribes Free Acres	Ribes Present					Total Ribes	Total Acres
			Ave. No. Ribes per Acre					
		Acres	R. lac.	R. vis.	Total			
Dense Mature	680	630	25.05	9.86	34.91		21,990	1,310
Open Mature	2,832	16,006	37.00	5.88	42.88		686,414	18,838
Dense Pole	25	0	0	0	0		0	25
Open Pole	230	40	50.00	0	50.00		2,000	270
Dense Repro.	35	410	3.00	26.00	29.00		11,890	445
Open Repro.	0	5,441	34.75	53.24	87.99		478,784	5,441
Totals & Averages	3,802	22,527	35.53	17.99	53.32		1,201,078	26,329
Stream	6	255						261
Grand Total	3,808	22,782						26,590

C. Coeur d'Alene Timber Protective Association:

1. Detailed Location:

T. 41 N. R. 2 E. Sections 4-6.
T. 42 N. R. 1 W. Sections 1-4, 9-15.
T. 42 N. R. 1 E. Sections 1-12, 14-18, 21-24, 25-28, 34-36.
T. 42 N. R. 2 E. Sections 1-4, 7-10, 15-18, 19-22, 27-30, 31-33.
T. 43 N. R. 1 W. Sections 35, 36.
T. 43 N. R. 1 E. Sections 4-9, 15-22, 27-34.
T. 43 N. R. 2 E. Sections 1-24, 25-29, 33-36.
T. 43 N. R. 3 E. Sections 1-36.
T. 44 N. R. 1 W. Sections 13-16, 20-28, 33-36.
T. 44 N. R. 1 E. Sections 21-28, 31-33.

2. Results of Work:

TABLE NO. 9

Acreage and Per Cent of Types Covered by Reconnaissance Coeur d'Alene Timber Protective Association 1928.

Type	Acres	Per Cent
White Pine	52,204	46.89
Stream	1,000	.89
Other Timber	29,559	26.54
Forest Land Not Reproducing		
Brush	5,719	5.14
Burn	19,959	17.92
Cutover	0	0
Non-forested Land		
Cultivated	1,508	1.35
Meadow	1,411	1.27
Barren	0	0
Rock	0	0
Totals	111,360	100.00

TABLE NO. 10

Age Classes by Eradication Types. (White Pine Only) Coeur d'Alene Timber Protective Association 1928

Eradication Type	Age Classes								
	0-10	11-20	21-40	41-60	61-80	81-100	101-200	200+	Total
Dense Mat.							691		691
Open Mat.					127	1,473	14,264	4,790	20,654
Dense Pole				475	270				745
Open Pole			105	1,647	3,598	280			5,630
Dense Rep.			749						749
Open Rep.	592	4,442	17,127	1,574					23,735
Total	592	4,442	17,981	3,696	3,995	1,753	14,955	4,790	52,204

TABLE NO. 11

White Pine Area Covered by Reconnaissance
Coeur d'Alene Timber Protective Association 1928

Eradication Type	Intensive	Extensive	Total Acres
Dense Mat.	63	628	691
Open Mat.	5,368	15,286	20,654
Dense Pole	0	745	745
Open Pole	2,404	3,226	5,630
Dense Rep.	115	634	749
Open Rep.	7,103	16,632	23,735
Stream	309	691	1,000
Totals	15,362	37,842	53,204

TABLE NO. 12

Ribes Per Acre on White Pine Type Covered by Intensive
Reconnaissance Coeur d'Alene Timber Protective Association 1928

Eradication Type	Ribes Free Acres	Ribes Present					Total Ribes	Total Acres
		Acres	Ave. No. Ribes per Acre					
			R. lac.	R. vis.	Total			
Dense Mature	63	0	0	0	0		0	63
Open Mature	0	5,368	47.35		60.62		325,376	5,368
Dense Pole	0	0	0	0	0		0	0
Open Pole	225	2,179	22.55	11.17	33.72		73,484	2,404
Dense Repro.	0	115	2.67	20.91	23.58		2,835	115
Open Repro.	0	7,103	30.70	32.90	63.60		451,844	7,103
Totals & Averages	288	14,765	34.66	22.05	56.71		853,539	15,053
Stream	0	309						309
Grand Total	288	15,074						15,362

D. Potlatch Timber Protective Association:

1. Detailed Location:

T. 39 N. R. 1 E.	Sections 1-18.
T. 39 N. R. 3 E.	Sections 1-4, 10-12.
T. 39 N. R. 4 E.	Sections 4-8, 18.
T. 40 N. R. 3 E.	Sections 1-5, 8-12, 15-17, 20-29, 33-36.
T. 40 N. R. 4 E.	Sections 1-12, 14-22, 28-33.
T. 41 N. R. 2 E.	Sections 1-12.
T. 41 N. R. 3 E.	Sections 1-17, 20-29, 32-36.
T. 41 N. R. 4 E.	Sections 1-36.

2. Results of Work:

TABLE NO. 13

Acreage and Per Cent of Types Covered by Reconnaissance Potlatch Timber Protective Association 1928

Types	Acres	Per Cent
White Pine	81,974	86.0
Stream	1,092	1.1
Other Timber	7,127	7.5
Forest Land Not Reproducing		
Brush	2,604	2.7
Burn	1,730	1.8
Cutover	0	0
Non-forested Land		
Cultivated	0	0
Meadow	563	.6
Barren	80	.1
Rock	160	.2
Total	95,330	100.0

TABLE NO. 14

Age Classes by Eradication Types. (White Pine Only) Potlatch Timber Protective Association 1928

Eradication Type	Age Classes								
	0-10	11-20	21-40	41-60	61-80	81-100	101-200	200+	Total
Dense Mat.						787	20		807
Open Mat.					240	3,026	62,694	2,355	68,315
Dense Pole					50				50
Open Pole				280	165				445
Dense Rep.			375						375
Open Rep.	20	755	10,775	432					11,982
Total	20	755	11,150	712	455	3,813	62,714	2,355	81,974

TABLE NO. 15

White Pine Area Covered by Reconnaissance Potlatch Timber Protective Association 1928

Eradication Type	Intensive	Extensive	Total Acres
Dense Mat.	250	557	807
Open Mat.	19,846	48,469	68,315
Dense Pole	50	0	50
Open Pole	230	215	445
Dense Rep.	195	180	375
Open Rep.	3,241	8,741	11,982
Stream	501	591	1,092
Total	24,313	58,753	83,066

TABLE NO. 16

Ribes per Acre on White Pine Type Covered by Intensive Reconnaissance Potlatch Timber Protective Association 1928

Eradication Type	Ribes Free Acres	Ribes Present					Total Ribes	Total Acres
		Acres	Ave. No. Ribes per Acre					
			R. lac.	R. vis.	Total			
Dense Mature	250	0	0	0	0		0	250
Open Mature	3,197	16,649	28.68	4.53	33.21		552,977	19,846
Dense Pole	50	0	0	0	0		0	50
Open Pole	230	0	0	0	0		0	230
Dense Rep.	195	0	0	0	0		0	195
Open Reproduction	665	2,576	7.20	13.67	20.87		53,743	3,241
Totals & Averages	4,587	19,225	25.80	5.76	31.56		606,720	23,812
Stream	66	435						501
Grand Total	4,653	19,660						24,313

V. Collection of Data

Data regarding the ownership of timber lands in the white pine area of north Idaho have been collected and recorded in permanent form. These records have been corrected each year for changes in ownership. This has not been done since the last annual report was written.

VI. Summary

The following tables are a summary of all reconnaissance work done in Idaho during the 1928 field season:

Reconnaissance Summary Table No. 1

Per Cent of Each Association and National Forest Covered by Reconnaissance

Unit	Area in Acres	Acres Worked 1923	Acres Worked 1924	Acres Worked 1925	Acres Worked 1926	Acres Worked 1927	Acres Worked 1928	Total Acres Worked to Date	% of Total Area Worked to Date
Clearwater T.P.A.	702,760		1,915	3,480	38,400	60,160	144,853	248,808	35.40
Coeur d'Alene, T.P.A.	1,301,000*		786	6,911	46,240	48,640	111,360	213,937	16.44
Pend Oreille T. P. A.	865,800		3,522	4,640	33,280	46,400		87,842	10.15
Potlatch, T. P. A.	705,261		6,204	3,920	39,164	62,400	95,330	207,018	29.35
Priest Lake, T.P.A.	237,000		18,632	23,260	37,945	107,391		187,228	79.00
Clearwater N. F.	907,846						907,846	907,846	100.00
Coeur d'Alene N.F.	790,234			106,360	251,746			358,106	45.32
Kaniksu N. F.	657,620	5,510	22,106	25,310		147,182		200,108	30.43
Pend Oreille, N. F.	874,738					241,479		241,479	27.61
St. Joe N. F.	867,450				37,850	426,860	39,957	504,667	58.18
Total	7,910,709	5,510	53,165	173,881	484,625	1,140,512	1,299,346	3,157,039	39.91

*Exclusive of land inside national forest boundaries.

Reconnaissance Summary Table No. 2.

Acreage and Per Cent of Types Covered by
Reconnaissance 1928

Land Division	Acres	Per Cent
White Pine Type	461,311	35.50
Stream Type	12,282	.95
Other Timber Types	314,862	24.23
Forest Land Not Reproducing		
Brush	431,640	33.22
Burn .	47,174	3.63
Cutover	480	.04
Non-forested Land		
Cultivated	1,508	.12
Meadow	4,422	.34
Barren	19,671	1.51
Rock	5,996	.46
Totals	1,299,346	100.00

Reconnaissance Summary Table No. 3

Age Classes by Eradication Types (White Pine Only) 1928

Erad. Type	Age Classes 0-10	11-20	21-40	41-60	61-80	81-100	101-200	200+	Total Acres
D.M.						2,147	3,156	70	5,373
O.M.					5,094	55,495	221,190	40,850	322,629
D.P.			50	1,591	1,005				2,646
O.P.			896	9,316	10,652	1,845			22,709
D.R.		1,101	3,457	127					4,685
O.R.	12,113	28,359	57,463	5,334					103,269
Totals	12,113	29,460	61,866	16,368	16,751	59,487	224,346	40,920	461,311

Reconnaissance Summary Table No. 4

Ribes Per Acre on White Pine Type Covered by Intensive Reconnaissance 1928

Eradication Type	Ribes Free Acres	Ribes Free Per Cent	Ribes Present Acres	Ribes Present Per Cent	Ave. No. Ribes Per Acre	Total Ribes	Total Acres
Dense Mature	993	55.39	800	44.61	28.13	22,500	1,793
Open Mature	11,887	16.89	58,473	83.11	46.60	2,724,804	70,360
Dense Pole	92	100.00	0	0	0	0	92
Open Pole	816	18.07	3,701	81.93	38.38	142,044	4,517
Dense Repro.	354	33.59	700	66.41	27.79	19,450	1,054
Open Reproduction	1,568	6.86	21,284	93.14	89.08	1,896,050	22,852
Totals & Averages	15,710	15.61	84,958	84.39	56.56	4,804,848	100,668
Stream	91	3.54	2,477	96.46			2,568
Grand Total	15,801	15.31	87,435	84.69			103,236

Reconnaissance Summary Table No. 5

White Pine Area Covered by Reconnaissance 1928

Eradication Type	Extensive Reconnaissance	Intensive Reconnaissance	Total
Dense Mat.	3,580	1,793	5,373
Open Mat.	252,269	70,360	322,629
Dense Pole	2,554	92	2,646
Open Pole	18,192	4,517	22,709
Dense Rep.	3,631	1,054	4,685
Open Rep.	80,417	22,852	103,269
Stream	9,614	2,668	12,282
Total	370,257	103,336	473,593

Reconnaissance Summary Table No. 6

Time Analysis Summary in Man Days 1928

Unit	Reconn-aissance	Train-ing	Travel	Mov-ing Camp	Office	Rain	Sick	Sun-days & Holi-days	Fire	Total
Clearwater T. P. A.	279	5	44	20	14	10	4	67	8	451
Coeur d'Alene T. P. A.	189		11	9	11	8		44		275
Potlatch T. P. A.	189	20	5	37	19	37		55		365
Clearwater N. F.	751	71	220	33	86	12	1	161	39	1,374
Totals	1,408	96	280	99	130	67	11	327	47	2,465

Reconnaissance Summary Table No. 7

Cost of Training Period 1928

Unit	Subsistance	Equipment	Transportation of Men	Salaries	Total Cost	No. of Men	Cost per Man
Clearwater T. P. A.	$ 6.00	$	$	$ 15.17	$ 21.17	5	$ 4.23
Coeur d'Alene, T.P.A.						3	
Potlatch T. P. A.	20.25	2.87		80.83	103.95	4	25.99
Clearwater N. F.	106.50		5.62	248.37	360.49	17	21.21
Total	$ 132.75	$ 2.87	$ 5.62	$ 344.37	$395.61	29	$ 13.64

Reconnaissance Summary Table No. 8

Cost of Reconnaissance 1928

Unit	Subsistance	Equipment	Transportation of Men	Salaries	Total Cost	Acres Worked	Cost per Acre
Clearwater T.P.A.	$ 441.75	$ 160.26	$ 57.63	$1.471.55	$ 2.131.19	$ 144.853	$ .015
Coeur d'Alene T.P.A.	337.09	46.54	87.77	914.30	1.385.70	111.360	.012
Potlatch T. P. A.	428.52	205.58	9.58	1,141.67	1,785.35	95,330	.019
Clearwater N. F.	1,879.50	320.89	106.73	4,718.92	7,026.04	947.803	.007
Total	$ 3,086.86	$ 733.27	$ 261.71	$8.246.44	$12,328.28	$1,299.346	$ .009

SCOUTING FOR BLISTER RUST IN IDAHO - 1928

By

H. N. Putnam, Associate Pathologist

I. Purpose

The purpose of scouting for blister rust in Idaho during the 1928 field season was two-fold: (a) to determine the extent and amount of blister rust present in the Idaho white pine forests; and (b) to obtain a basis for estimating the number of acres of stream type in the white pine belt containing *Ribes petiolare* and *Grossularia inermis*.

II. Location of Work

The entire white pine belt of Idaho was considered as the region to be scouted. This included the white pine forests in the counties of Benewah, Bonner, Boundary, Clearwater, Idaho, Kootenai, Latah, and Shoshone. Special attention was given by members of the scouting project to those regions not covered by men on other projects.

III. Known Infection Conditions Previous to 1928

The weather conditions in the spring and summer of 1927 were favorable to the spread of the rust due to the frequent rains thruout the season. One infection on *G.inermis* in Bonner County, 7 miles north of Priest River, was found in 1927. Based on the belief that blister rust would be most likely to spread southward from the infected areas near Nelson, B. C., the limited scouting time available in 1927 was devoted to the northern portion of the western white pine belt. It is highly possible that had time permitted, blister rust would have been found in the southern portion of the white pine belt in 1927.

IV. Organization of Work

A. Spring Scouting.

On May 10, 1928 blister rust was found on pines at Newman Lake, Washington, an account of which may be found in the report: "Scouting for Blister Rust in Washington". Analysis of the cankers found at Newman Lake showed quite definitely that infection originated in 1923.

In an effort to locate centers of pine infection in Idaho, an intensive scouting campaign was undertaken from May 15 to June 10. Such members of the office as could be spared were used in this work. The drainages leading into Coeur d'Alene, Hayden, Hauser, Twin, and Spirit lakes were scouted, as well as portions of the west branch of Priest River.

The method of scouting consisted in an examination of pines in association with *R.petiolare* or *G.inermis.* No Ribes inspections were made because it was too early for infection to show on Ribes.

B. Summer Scouting

1. Personnel. The personnel employed consisted of H. N. Putnam in charge; his permanent assistant, E. L. Joy; and four temporary assistants. In addition, R. L. MacLeod acted in charge of the project in the absence of the Supervisor. These men were divided into three crews of two men and an automobile each.

2. Methods of Work. The methods used in scouting can best be shown by a quotation from the "Instructions for Scouting--" issued to each scout. The excerpt is given as follows:

> "A. Scouting by scouting project: For men devoting their entire time to scouting for blister rust, the following rules apply:
>
> 1. Confine scouting chiefly to stream types in which R.petiolare or G.inermis are in association with white pines.
> 2. Scout consecutive drainages, locating and inspecting in each drainage all associations of R.petiolare or G.inermis and white pines.
> 3. In early summer, until about August 1, devote attention chiefly to white pines in association with R.petiolare and G.inermis. After August 1, until Ribes leaves fall, devote attention chiefly to above-mentioned Ribes species in association with white pines. However, at all times inspect pines associated with R.petiolare and G.inermis whether or not the Ribes species show infection. Experience gained in scouting has shown that light pine infection often occurs when infection on associated Ribes species is very slight and difficult to find.
> 4. Inspect carefully both pines and Ribes occurring in the environs of previously found infections.
> 5. In recording results, the following rules will be observed:
>   a. In scouting stream type show limits of R.petiolare and G.inermis, white pine types by age classes on map, average width of stream type, eradication class, number of pines and Ribes bushes examined and infected. Use scouting form No. 57.
>   b. In case infection on either host is found, use scouting form No. 38.
>   c. To record the occasional inspection made, use scouting form No. 38."

3. Report forms used. The two forms, No's. 57 and 38, mentioned in the preceding quotation, are shown following:

WF-BRC-#57-6/18/28

Scouting Form

	Ribes												White Pine			
			R. petiolare			G. inermis										
Sec.	Type Width Ch.	Insp. No.	Abund	Exam	Inf.	Abund	Exam	Inf.	Abund	Exam	Inf.	Erad. Type	Occur	Age Class	Exam	Inf

WF-BRC-38-7/15/27

Scouting for Blister Rust

Owner ____________________ | State ______ Co ________ No ________
Location: | T. ________ R. __________ Sec. ________
 | Inspector   Date

White Pine Species

Occurrence (Scattered, abundant, etc.)	Age Class	Height	Condition	Number Examined	Number Infected

Individual Pine Infection

Pine No.	Age	Height	Crown Class	Number Cankers		Remarks: Trunk killed, number of branches killed, secondary infection, etc.
				Trunk	Branch	

Age of Infection

Year of Growth Infected	Number of Cankers							
	1st Symptoms	Juvenile	1st Pycnia	Pycnial Scars	Produced Aecia			Dead
					First Time	Twice	Several Times	
1926								
1925								
1924								
1923								
1922								
1921								
1920								
1919								
1918								
1917								
1916								

4. Training of scouts. Men engaged in scouting for blister rust were given an intensive period of training from June 20 to 26 inclusive. They were shown the disease on Ribes species and white pines at Newman Lake, Washington. In the general vicinities of Coeur d'Alene and Wallace, Idaho, the different species of Ribes commonly found in the white pine belt were studied. The method of scouting for the disease and recording results was stressed. Attention was given to the method of estimating the amount of stream type supporting *R. petiolare* or *G. inermis*, and the determination of eradication types.

From July 6 to July 8 inclusive members of the scouting project studied the disease near Nelson, B. C., where special attention was given to the analysis of cankers.

C. Scouting by Associated Projects.

1. Methods of scouting. The methods of scouting employed by men on the associated projects varied considerably. In the eradication camps usually the project supervisors, camp bosses, and one or two additional men did the scouting. Among the control reconnaissance and ecology forces, practically every man did a certain amount of scouting for blister rust when opportunity offered.

2. Reports. Reports were made at the end of the season by each project leader, showing an estimated number of Ribes by species and white pines inspected on the areas concerned.

V. Results of Scouting.

The results of scouting are shown divided into two parts, namely: (1) spring scouting, and (2) summer scouting. No attempt is made in this report to show the number of acres of stream type containing *R. petiolare* or *G. inermis*, since that particular phase of the work is not completed.

A. Spring Scouting.

Scouting for blister rust in late May and early June, 1928, was conducted in Bonner and Kootenai counties. Work was limited chiefly to inspections of white pines in close association with *G. inermis* along streams.

Table No. 1 gives the results of such scouting. No infection was found.

TABLE NO. 1

RECORD OF WHITE PINES EXAMINED FOR BLISTER RUST
IN IDAHO, MAY AND JUNE, 1928.

County	Region	Number Pines Examined
Bonner	West Branch of Priest River	1,375
Kootenai	Hayden and Coeur d'Alene Lakes	1,315
	Hauser Lake	2,184
	Twin Lakes	125
	Spirit Lake	704
Total		5,703

B. Summer Scouting.

The results of scouting in the main portion of the field season are shown in two divisions, namely: (1) record of total scouting performed, and (2) record of infections found.

1. Statement of total scouting performed in Idaho, summer 1928. In Table No. 2 is shown the number of host plants inspected, classified by counties and projects.

TABLE NO. 2

RECORD OF INSPECTIONS MADE BY MEMBERS OF ALL PROJECTS CLASSIFIED BY COUNTIES, IDAHO, JUNE 15 TO SEPT. 30, 1928.

County	Project	Infection Points	Ribes Species Examined														White pine Examined	
			R.nigrum		R.pet.		G.inermis		R.laxiflo		R.visco.		R.lacustre		Tot.Ribes			
			Exam	Inf.	Exam.	Inf.	Exam.	Inf.	Exam.	Inf.	Exam.	Inf	Exam.	Inf.	Exam.	Inf.	Exam.	Inf.
Benewah	Scouting Project	0			350	0	125	0							475	0	13	0
	Reconn.Cd'A.T.P.A.	1	12	1	36	0									48	1		
	Chemical Erad.	0			10	0	200	0							210	0	5	0
	Ecology	0			50	0	100	0			100	0	50	0	300	0	50	0
Bonner	Scouting Project	4			40	0	3,572	11	3,940	1	105	0	107	0	7,764	12	7,457	0
	Erad. P.L.T.P.A.	0					590	0							590	0	50	0
	Re-eradication	0					1,200	0							1,200	0	2,000	0
	Ecology	0					10	0			500	0	50	0	560	0	50	0
Boundary	Scouting Project	0	4	0			1,888	0	73	0	32	0			1,997	0	3,634	0
Clear-water	Scouting Project	20			26,100	128	117	0					17	2	26,234	130	2,900	0
	Chemical Erad.	1			705	1	55	0							760	1	135	0
	Reconn. [illegible] P.T.P.A	0			500	0							500	0	1,000	0	500	0
	Reconn. C.T.P.A.	0			500	0							50	0	550	0	100	0
	Fed.Cont.Reconn.	0			2,680	0									2,680	0	7,500	0
	Ecology	0			100	0	25	0			50	0	25	0	200	0	25	0
Idaho	Fed.Cont.Reconn.	0															2,500	0
Kootenai	Scouting Project	0					60	0					10	0	70	0	145	0
	Hand Eradication	0			40	0	1,495	0							1,535	0	2,515	0
Latah	Scouting Project	3			360	9	4	1					2	0	366	10	25	0
	Ecology	0					50	0			500	0	300	0	850	0	100	0
Shoshone	Scouting Project	3			1,484	57	1,363	0			180	0	288	0	3,315	57	3,224	0
	Reconn.Cd'A.T.P.A	1			200	20									200	20		
Totals	All Projects	33	16	1	33,155	215	10,854	12	4,013	1	1,467	0	1,399	2	50,904	231	32,928	0

That interest in finding blister rust existed among the entire force of blister rust workers is shown in Table No. 2. Men on projects other than the scouting project examined 9,683 Ribes bushes, 19% of the total; and 15,530 white pines, 47% of the total. These men also reported 3 of the 33 infections found. When it is considered that these men inspected the host plants as shown above entirely in addition to their own particular jobs, the figures are still more striking.

2. Record of infections found in Idaho. In Table No. 3 is shown a summary of all infections found in Idaho in 1928, classified by counties.

TABLE NO. 3

RECORD OF BLISTER RUST INFECTIONS FOUND 1928, IDAHO.

County	Region	T.	R.	Sec.	Host Infected	Number Examined	Number Infected	Per Cent Leaves Infected Per Infected Bush	*Pine Association	Situation Infected Bush	Inspector	Date	Remarks
Benewah	Tyson Mining Company Mill site.	44N	1W	SW/4 35	R. nigrum	12	1	1 spot on each of two leaves	Excellent	Dry site.	G.Whiting	9/13	Bushes pulled up.
Bonner	Near Gleason Ranger Station, Kaniksu National Forest. Small Creek on Priest River.	58N	4W	6	G. inermis	75	[illegible]	1%	Fair	Heavy shade in swamp.	Putnam E. Joy	8/11 8/12	Swamp in cut and burned over area.
	Moore Creek near Gleason Ranger Station, Kaniksu National Forest.	58N	5W	16	G. inermis	150	1	1%	Excellent	Heavy shade in swamp.	K.Miller	8/20	Surrounded by White Pine 81-100.
	Moore Creek near Gleason Ranger Station, Kaniksu National Forest.	58N	5W	15	G. inermis	150	1	1 leaf to 5%	Excellent	Heavy shade in swamp.	K.Miller E.Joy	8/21	Infected bushes in 3 spots 250 feet from each other.
	Battle Creek, Pend Oreille National Forest.	57N	3E	[illegible]	R. laxiflorum	400	1	3 leaves 2%	Fair	On open hill side.	Putnam E.Joy	8/14	2 year old bush on 1926 burn.
Clearwater	East Fork Potlatch Creek at Chemical Eradication Camp near Bovill, Idaho	41N	2E	30	R. petiolare	125	1	3%	Excellent	In open, over stream.	Strong Bell Anderson	8/18 8/24	
	Elk Creek, 1½ miles southeast of city of Elk River below dam.	40N	2E	35	R. petiolare	251	1	1 leaf	Excellent	In half shade over stream.	Putnam	8/27	In deciduous shade.
	Deep Creek, 5 miles southeast of city of Elk River.	39N	2E	12	R. petiolare R. lacustre	150 2	30 2	65% 2%	Excellent	Mostly over stream.	Brown Taylor E.Joy	8/28 9/4	In midst of pines 21-40 years old. Contiguous to infected R.petiolare.
	Junction Deep Creek and Elk Creek 5 miles south of city of Elk River.	39N	2E	14 23	R. petiolare	191	50	5% to 90%	Excellent	Along and over stream mostly in open.	Brown Taylor E.Joy	8/29 9/4	Infection on R. petiolare for 2 miles along creek. Pines 21-40 and older. Closely associated.
	Elk Creek 4 miles north of city of Elk River	40N	2E	14	R. petiolare	600	1	3 leaves	Excellent	?	Brown	8/31	
	Orofino Creek 3 miles south of Pierce.	36N	5E	13	R. petiolare	235	1	13 leaves to 2%	Excellent	Along creek in open in placer mining area	K.Miller	8/31	White pine 21-40 within 5 feet.
	Bull Run Creek near city of Elk River.	39N	2E	10	R. petiolare	300	1	5%	Excellent	Next to cool moist rock wall in open.	E.Joy Brown	9/5	Young pines in close association.
	Elk Creek near Elk River.	40	2E	35	R. petiolare	75	1	1 leaf	Excellent	[illegible]	Brown	9/4	Young pines in close association.
	North Fork Orogrande Creek, Oxford Ranger Station.	38N	7E	33	R. petiolare	275	[illegible]	[illegible]	Excellent	Near creek in open but not overhanging creek	Miller	9/5	
	Silver Creek, Oxford Ranger Station.	38N	6E	26	R. petiolare	1,550	1	35%	Excellent	Infected bush in open near [illegible]	Taylor	9/7	
	North Fork Reed Creek, 3½ miles northeast of Clearwater Timber Company headquarters	39N	5E	36	R. petiolare	1,000	[illegible]	5%	Excellent	Half shade bordering stream.	Putnam Loseth E.Joy	9/10	Light infection on area 36 square feet. Beaver swamp 2 chains wide.
	North Fork Reed Creek, 2½ miles northeast of Clearwater Timber Company headquarters.	38N	5E	[illegible]	R. petiolare	1,000	[illegible]	4 leaves, 2 leaves contiguous branches	Excellent	Half shade overhanging stream.	Loseth Putnam E.Joy	9/10	White pine 81-100 years within 75 feet.
	North Fork Reed Creek, ¼ mile southwest of Clearwater Timber Company headquarters.	38N	5E	16	R. petiolare	300	20	1% to 75%	Excellent	Half shade adjacent to and overhanging stream.	Loseth Putnam E.Joy	9/11 9/13	Infected area 20 feet by 30 feet. Infection heaviest in center. Young uredinia on leaves close to water.
	North Fork Reed Creek, 2½ miles southwest of Clearwater Timber Company headquarters.	38N	5E	16	R. petiolare	600	1	2% (8 leaves)	Excellent	Three-fourths shade overhanging stream.	Putnam E.Joy	9/11	Old telia molded. Young uredinia on leaves near water. 1 white pine 10 feet tall within 8 feet. White pine 81-100 years within 50 feet.
	Tributary of South Fork of Reed Creek, 6/10 mile north of Clearwater Timber Protective Association headquarters.	38N	5E	SE/4 32	R. petiolare	300	[illegible]	[illegible]	Excellent	In open. Bushes overhanging stream.	E.Joy Putnam	9/13	Young uredinia and young telia. Infection on 36 square feet. Near sign over road reading, "No campers allowed beyond this sign."
	Orofino Creek next to Clearwater National Forest line.	36N	5E	13	R. petiolare	631	1	[illegible]	Excellent	In open over stream	F.L.Joy	9/13	
	Small tributary of Orofino Creek near Pierce.	36N	5E	SW/4 10	R. petiolare	275	1	[illegible]	Excellent	In open.	Miller Taylor	9/13	300 yards from cement water trough towards Pierce on road from Weippe. Infection on top of tall R.petiolare bush within 5 feet of white pine tree.
	Headquarters Clearwater Timber Protective Association. Back of pump house. South Fork of Reed Creek.	38N	5E	26	R. petiolare	100	1	2%	Excellent	Solitary bush in open over stream.	E.Joy Putnam	9/14	40 feet from white pine 81-100 years old.
	Shanghai Creek 6 miles northeast of Pierce on Oxford Road 3 miles above bridge across Shanghai Creek.	37N	6E	19	R. petiolare	300	1	1% (4 leaves)	Very Good	Half shade over dry Beaver dam.	F.Joy Brown	9/14	Patchy sub-alpine growth.
	Small branch of south Fork Breakfast Creek near summit of road Pierce to Bungalow Ranger Station.	37N	6E	NE/4 of NE/4 17	R. petiolare	500	2	2%	Excellent	In open over creek in old burn.	K.Miller E.Joy	9/15	Heavy pine reproduction on ridges and slopes. R. petiolare heavy in patches.
	Rhodes Creek 6 miles southwest of Pierce. Just outside northwest corner Clearwater National Forest.	37N	5E	36	R. petiolare	200	[illegible]	5%	Excellent	On narrow strip between two streams. Beaver dam. Very wet.	F.Joy Brown K.Miller E.Joy	9/17	White pine scattered. 1000 feet above old gold dredge.
Latah	West Fork Potlatch Creek, 8½ miles east of Bovill on road to Clarkia.	42N	1E	32	R. petiolare	50	[illegible] 1 1	98% 3 leaves 1 leaf	Excellent	In open. Low bushes over stream.	K.Miller E.Joy	9/21	
	West Fork Potlatch Creek 4 miles east of Bovill near Collins.	41N	1E	7	G. inermis	10	1	1 leaf	Fair	Full shade of alder. Not over stream.	Putnam	8/24	One spot. Puccinia species surrounded by uredinia. Determined by Dr. Hedgcock.
	West Fork St. Maries River, 1 mile east of summit of road between Bovill and Clarkia.	42N	1E	33	R. petiolare	50	1	2% - 11 leaves	Excellent	Complete shade of alder over stream.	Miller E.Joy	9/21	Young white pine within 50 feet.
Shoshone	Merry Creek Site of Chemical Eradication Camp 1926-27. 1¼ milee northeast of Clarkia.	42N	2E	4	R. petiolare	400	53	1 leaf to 25%	Excellent	Half shade over-hanging stream	MacLeod Putnam	8/24	Four infections found along 3/4 mile of creek. Pines 21-40 years closely associated.
	St. Maries River 1½ miles north of Clarkia on road to Santa.	43N	3E	36	R. petiolare	40	[illegible]	2%	Excellent	Half shade over stream.	MacLeod Putnam	8/24	White pine, 41-100 within 50 feet.
	Along East Fork St. Maries River toward Gold Center.	42N	2E	5,8,4 9,10, 11,12	R. petiolare	200	20	10%	Excellent	Over stream and adjoining in open and half shade.	G.Whiting MacLeod Putnam	9/10 9/21	Heavy infection for 7 miles along creek. White pine 21-40 adjoining creek.
	Canyon Creek in town of Burke.	48N	5E	10	R. petiolare	75	[illegible]	.1%	Very Good	Open. Over stream	MacLeod	9/25	Bushes 10% defoliated.

*By "Pine Association" is meant the distance from infected Ribes to pines according to the following legend:

Excellent - Pines within 100 feet		Fair - Pines 501 to 1000 feet distant	
Very Good - Pines 101 to 250 feet distant		Poor - Pines 1001 to 1500 feet distant	
Good - Pines 251 to 500 feet distant		Very Poor - Pines over 1500 feet distant	

1928 Annual Report
H. N. Putnam

An examination of Table No. 3 brings out the fact that in every one of the 33 infections found, pines existed sufficiently close to infected Ribes bushes to receive infection from them.

Blister rust on R. petiolare and G. inermis was found in 5 of the 6 counties of Idaho supporting white pines in commercial quantities. Boundary County, in which no infection was found, is the northernmost county in Idaho.

VI. Costs

In Table No. 4 is shown the costs of this project during the 1928 calendar year.

TABLE NO. 4

COSTS OF SCOUTING FOR BLISTER RUST IN IDAHO, 1928.
PROJECT 4.12

Name	Period	Salaries	Subsistence	Transportation: Pers.auto 7¢ per mi.	Transportation: Other	Equipment	Misc.	Total
Putnam Joy	Calendar yr.(except 6/15 to 9/30)	$ 698.34						$ 698.34
Spring Scouting	5/10 to 5/26	*	$ 25.50		$14.87			40.37
Summer Scouting	6/15 to 9/30	2,301.36	1,143.61	$697.48	8.25	$60.00	$7.92	$4,218.62
Grand Total	Calendar Yr. 1928	$2,999.70	$1,169.11	$697.48	$23.12	$60.00	$7.92	$4,957.33

*Salaries of men performing scouting in the spring charged to their respective projects.

In the "Transportation, Other" column is an item of $14.87. This figure is chiefly for gas and oil purchased for use in government owned trucks used in spring scouting.

The item of $8.25 in the same column is composed chiefly of the few stage and railroad fares used during the summer scouting.

The equipment charge of $60.00 represents the entire technical and field equipment depreciation charged against this project.

Miscellaneous costs are those for telephone and telegraph messages, colored crayons, etc.

During the summer scouting there were 532 man days during which the scouts' expenses were paid by the government. The subsistence cost per day, then was $\frac{\$1143.61}{532} = \$2.15$ per man day.

This subsistence cost per man day was low because a large part of the time was spent on the different national forests, where there was no charge for lodging, and where the usual charge for meals was 40 cents per meal.

During the summer months personally owned autos were driven for official use 9,964 miles at 7 cents per mile. The item of transportation will always be high when men are engaged in scouting, due to the large amount of travel necessary to cover the territory.

There was a total of 581 man days used in the summer scouting in Idaho. The number of miles traveled in personally owned autos, then, was $\frac{9964}{581} = 17.1$ miles per day.

The cost of scouting in the summer per man day was

$$\frac{\$4218.62}{581} = \$7.26 \text{ per man day.}$$

This is believed to be a fair cost per man day for scouting in Idaho.

VII. Summary and Conclusions

Blister rust on *R. petiolare* and *G. inermis* was found distributed practically over the entire western white pine belt of Idaho in 1928. No pine infection was found, but concentrations of Ribes infection at Clarkia and Elk River in the southern portion of the white pine belt indicate the presence of undiscovered small centers of pine infection in these two vicinities.

BLISTER RUST CONTROL WORK IN WASHINGTON
1928

Blister rust control work in Washington was carried on, as in the past, as a cooperative project between the Washington State Department of Agriculture and the Bureau of Plant Industry. The basic memorandum of understanding upon which this work was organized was made effective July 1, 1927 and can be found in the report for that calendar year. The following is the amendment to this memorandum to cover the work as organized for the Federal fiscal year 1929, beginning July 1, 1928:

"AMENDMENT TO
MEMORANDUM OF UNDERSTANDING
Effective July 1, 1927

Between
THE UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY
and the
WASHINGTON STATE DEPARTMENT OF AGRICULTURE.

Cooperative Work in Controlling White Pine Blister Rust in
WASHINGTON.

* * * * * *

"Paragraph C-6, of the Memorandum of Understanding described above contains the following:

"' For the Fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $13,000 to the support of this cooperative work, and the Washington State Department of Agriculture shall contribute in value approximately $8,000; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence.'

"In accordance with the foregoing provision, it is mutually agreed that for the fiscal year ending June 30, 1929 there will be expended by the Washington State Department of Agriculture approximately $8,000.00, and by the United States Department of Agriculture, Bureau of Plant Industry, through its Office of Blister Rust Control, approximately $8,500.00 in connection with cooperative blister rust control work in Washington.

Date:	Signature:
June 18, 1928	(s) Erle J. Barnes Director, Washington State Department of Agriculture.
July 13, 1928	(s) Wm. A. Taylor Chief, Bureau of Plant Industry. "

CULTIVATED BLACK CURRANT SURVEY IN WESTERN WASHINGTON, 1928

By
A. E. Franklin
Agent

Purpose of Work.

This survey of that portion of the State of Washington west of the Cascade ridge was for the purpose of ascertaining the number and location of cultivated black currants not eradicated in 1922, planted since that time, and now upon sample farming sections and town and city blocks, and to secure other data for use in estimating the total number of plantings and plants now in western Washington.

Method Employed.

Owing to the limited time available for the work a sample method of examination was employed.

Rural inspections: The nineteen counties covered by this work were divided into four groups. The selections of counties in each group and the allotment to counties of the 131-1/2 sample sections inspected being such as to afford average farm and horticultural development of the respective counties and groups.

A plat and notes were made for each section inspected showing ownership, tract, total and cultivated acreage, cultivated black currants eradicated in 1922, not eradicated in 1922, planted since 1922 and the present number of plants and plantings.

Sections inspected are indicated on county maps, on file in the office. In the case of portions of Whatcom and Thurston counties in which cultivated black currants are grown on a commercial scale and where the number of plants was obviously greater than in average sections, four sections were examined, showing 17,355 plants in 12 plantings. These sections are not taken into account in computing average cultivated black currant plants in county and group.

Urban inspection: Thirteen cities and towns throughout the surveyed area were selected for inspection, as follows: five cities of over 10,000, four of 5,000 to 10,000, and four of less than 5,000 population.

Sample blocks were inspected in each of these cities. Notes of blocks inspected were made and, where procurable, city maps used to show locations.

In computing totals in urban areas, the estimated number of cultivated black currants per thousand population in the three classes

of cities and towns was taken. Using these percentages for the 105 incorporated towns and cities in three classes as above, the total plants in urban areas was computed.

Personnel

The work of inspection and preparation of data was performed by one man. Time devoted to the work, 145 man-days.

Results of Work.

The results of this survey are given in Tables 1 to 5. In these tables are given the results of the three types of survey made, the general rural survey, the special survey of particular rural localities, and the urban survey. Table 5 gives a general summary of the work and estimates of the number of cultivated black currants now growing in western Washington. These estimates are made on a population (1920 census) basis.

The inspection of 131-1/2 sample farming sections and sample blocks in thirteen of the larger cities and towns, indicates that there are 21,663 plants in the area. Of this total 18,878 are in rural and 2,785 in urban territory.

Of the 18,878 in rural sections, 17,355 plants are in Whatcom and Thurston Counties, all of those in Whatcom County being in four sections in the vicinity of Sumas and Nooksack. Over 15,000 of this 17,355 plants were planted since 1922.

An intensive survey of northern Whatcom County would, no doubt, show that there are a number of plantings not shown in this report, as heavy shipments of black currants are made from this region to British Columbia.

It is highly probable that such further inspection would show some ten to fifteen thousand plants in addition to those already located in Whatcom County.

TABLE NO. 1

CULTIVATED BLACK CURRANT SURVEY IN WESTERN WASHINGTON, 1928

Group and County Totals - Rural Areas
Not Including Special Sample Sections in Whatcom and Thurston Counties

Counties	Cultivated Acreage*	Inspected: Per Cent Cultivated Acreage	Inspected: Sections No.	Inspected: Acres Total	Inspected: Acres Cultivated	Cultivated Black Currants: Eradicated 1922	Cultivated Black Currants: Not Eradicated 1922	Cultivated Black Currants: Planted Since 1922	Present: No. Plantings	Present: No. Plants	Present: Estimated Total Plants in County	Population Farm Area	Plants Per 1000 Population
GROUP 1													
Skagit	73,243	2.79	7	4,480	2,038	15	0	0	0	0	0	17,362	0
Whatcom	73,673	7.16	14	8,960	5,276	47	14	0	2	14	196	19,621	10.0
San Juan	18,922	11.97	7	4,480	2,265	7	0	0	0	0	0	3,083	0
Totals	165,838	5.78	28	17,920	9,579	69	14	0	2	14	196	40,066	4.9
GROUP 2													
Pierce	41,953	4.77	11	7,040	2,048	0	0	0	0	0	0	32,307	0
Snohomish	53,410	2.65	11	7,040	1,417	34	0	0	0	0	0	28,148	0
Island	17,127	3.89	3	1,920	666	2	0	0	0	0	0	4,535	0
King	68,272	2.94	8	5,120	2,004	22	14	0	1	14	476	57,811	8.3
Kitsap	13,411	4.25	5	3,200	571	0	34	0	1	34	800	18,967	42.1
Totals	194,173	3.45	38	24,320	6,706	58	48	0	2	48	1,276	141,768	9.0
GROUP 3													
Clallam	20,132	4.55	3	1,920	916	0	0	0	0	0	0	5,616	0
Jefferson	8,457	3.81	5	3,020	322	0	0	0	0	0	0	3,710	0
Mason	8,373	4.85	5	3,200	406	0	0	0	0	0	0	3,935	0
Grays Harbor	28,798	2.85	9	5,760	823	2	0	0	0	0	0	13,757	0
Thurston	45,953	.50	3	1,920	228	0	0	0	0	0	0	12,807	0
Totals	111,713	2.41	25	16,000	2,695	2	0	0	0	0	0	39,825	0
GROUP 4													
Cowlitz	27,994	1.97	6	3,840	552	0	1	0	1	1	51	6,985	7.3
Wahkiakum	8,577	7.46	4	2,560	640	6	0	0	0	0	0	3,050	0
Pacific	10,509	3.88	8½	5,440	408	0	0	0	0	0	0	7,896	0
Lewis	79,322	.88	6	3,840	700	25	0	0	0	0	0	21,372	0
Clark	75,673	1.95	8	5,120	1,474	0	0	0	0	0	0	16,251	0
Skamania	5,334	3.15	4	2,560	168	0	0	0	0	0	0	2,009	0
Totals	207,409	1.90	36½	23,360	3,942	31	1	0	1	1	51	57,563	.9
Totals 4 Groups	679,133	3.38	127½	81,600	22,922	160	63	0	5	63	1,523	279,222	5.45

*Agri. Census 1920

Annual Report 1928
A. E. Franklin

TABLE NO. 2

CULTIVATED BLACK CURRANT SURVEY IN WESTERN WASHINGTON 1928

Plantings in Special Sections Inspected

County	Owner	Tract	Acres		Eradicated 1922	Not Eradicated 1922	Planted Since 1922	Present		Near
			Total	Cult.				Plantings	Plants	
Whatcom	Denson	Sec. 36 - 40 N 3 E.	1	1	0		90	1	90	Strandel
"	Nordstrom	" "	12	11	0		1,200	1	1,200	"
"	"	" "	70	40	0		1,200	1	1,200	"
"	Micklem	" "	18	8	0		4,000	1	4,000	"
"	Boho	" "	40	25	0		6,000	1	6,000	"
"	Boesch	" 2 - 40 N 4 E.	37	25	0		1,000	1	1,000	Sumas
"	Robacker	" "	40	20	0		400	1	400	"
"	Altman	" 32 - 40 N 4 E.	50	35	0		1,800	1	1,800	Nooksack
"	Lohman, Chas.	" 28 " " "	105	35	0	425	0	1	425	"
"	Pritts	" " " " "	27	37	0	40	0	1	40	"
"	Hoheusee	" 2 " " "	7	7	0	1,000	0	1	1,000	Sumas
Thurston	Beardsley (Hebron farm)	" 30 - 17 N 2 E.	160	50	0	200	0	1	200	Yelm
Totals Special Sections		4 Secs. (2,660 Acres)	587	294	0	1,665	15,690	12	17,355	

TABLE NO. 3

CULTIVATED BLACK CURRANT SURVEY IN WESTERN WASHINGTON 1928

Plants in Urban Areas, Cities and Towns Inspected

Population	Residence Blocks		Cultivated Black Currants in Area Inspected					Total (Estimated) in City	Population (1920 Census)	Plants per 1000 Population
						Present Totals				
	Total	Inspected	Eradicated 1922	Not Eradicated 1922	Planted Since 1922	Plantings	Plants			
Over 10,000										
Aberdeen	834	13	2	0	0	0	0	0	15,337	0
Bellingham	1,260	30	24	0	0	0	0	0	25,585	0
Everett	424	32	0	0	0	0	0	0	27,644	0
Tacoma	4,100	42	0	6	0	2	6	586	96,965	6.04
Vancouver	802	10	12	0	0	0	0	0	12,637	0
	7,420	127	38	6	0	2	6	586	178,168	3.28
5000 to 10,000										
Anacortes	716	17	0	0	0	0	0	0	5,284	0
Olympia	2,000	9	0	0	0	0	0	0	7,795	0
Port Angeles	495	11	0	5	0	2	5	225	5,351	42.05
Puyallup	87	10	0	7	0	2	7	61	6,323	10.37
	3,298	47	0	12	0	4	12	286	24,753	11.55
Under 5000										
Auburn	335	10	0	2	0	1	2	67	3,163	20.18
Chehalis	116	6	10	0	2	1	2	39	4,558	8.55
Mt. Vernon	200	10	0	0	0	0	0	0	3,341	0
Raymond	372	6	0	0	0	0	0	0	4,260	0
	1,028	32	10	2	2	2	4	106	15,322	6.92

TABLE NO. 4

CULTIVATED BLACK CURRANT SURVEY IN WESTERN WASHINGTON 1928

Estimated Number of Plants in Incorporated Places

Places	Population	Total Population	Plants Per 1000 Population	Estimated Total Plants
7	Over 10,000	503,538	3.28	1,652
6	5,000 to 10,000	41,220	11.55	476
92	Under 5,000	95,449	6.92	660
105	Totals	640,207	4.35	2,785

Summary of Cultivated Black Currant Survey in Western Washington, 1928

A brief summary of the results of the survey and the estimated number of cultivated black currant plants is as follows:

1. Cities

Average number of plants per thousand population		4.35	
Total population of cities	640,207		
Estimated total cultivated black currants in cities of Western Washington			2,785

2. Rural

5 special sections inspected in Whatcom and Thurston counties. Total number of plants found			17,355
Average number of plants per thousand population not including the above 5 sections		5.45	
Total rural population	279,222		
Estimated total cultivated black currant plants in rural areas			1,523

Estimated Grand Total of Cultivated Black Currant plants extant in Western Washington 21,663*

*Includes the plants found in Whatcom and Thurston Counties on the 5 special sections.

PRE-ERADICATION ON MT. RAINIER NATIONAL PARK

by
C. C. Strong
Assistant Forester

In accordance with your instructions a preliminary survey for the purpose of estimating cost of protecting certain areas of valuable white pine on Rainier National Park against possible damage by white pine blister rust has been completed. I personally supervised this work and was assisted by P. S. Simcoe.

Upon arrival at the Park a conference was held with the park superintendent, Mr. Tomlinson, and the chief ranger, Mr. Barnett. It developed that the Park Service people were especially interested in protecting certain limited areas in which white pine was sufficiently represented to form an integral part of the timber stands. In general white pine is sparsely scattered throughout many areas on the park but the loss of these scattered trees would scarcely be noticed. It is on the areas where loss of white pine would result in leaving ugly holes in the national timber stands that protection is contemplated.

It further developed that destruction of certain dense masses of currants and gooseberries by the cheapest method, toxic sprays, would result in considerable damage to other vegetation. Hence, it would be advisable to do only hand pulling, even though more expensive, should eradication be attempted. The prime motive which would govern this work would be preservation of natural beauty.

Most of the people who visit the park now enter through the Nisqually Valley at the southwest corner. From here the highway extends in as nearly a direct route as possible, to Paradise Valley by way of the Nisqually River. At the Longmire Springs there is a rather extensive area on which white pine constitutes a valuable component of timber stand. Although not of much value commercially it is of much value from the aesthetic standpoint. This stand extends for some distance about 1/4 mile west of and one mile east of Longmire, along the Nisqually River. It is perhaps 20 chains wide on the average. The part in which the Park people are most interested, however, is that immediately surrounding the Park Headquarters at Longmire Springs.

Centering about 2½ miles northeast of Longmire by air line is what is known as the Silver Forest. This area was at one time timbered with Alaska cypress or yellow cedar (*Chamaecyparis Nootkatensis*).

The area was burned and the white snags are still standing. Hence the name "Silver Forest". White pine is reproducing very well on the area. The beauty of these trees is almost unsurpassed. Certainly the white pine in the Silver Forest should be protected if eradication is attempted. This is the feeling of the Park people, I believe.

RIBES CONDITIONS

Ribes bracteosum, *R. lacustre* and *R. laxiflorum* are the species of Ribes found in the above areas. At no place, excepting a small area near Nisqually Glacier, was *R. bracteosum* found as dense as *R. petiolare* occurs at some points in Idaho. However, *R. bracteosum* represents a difficult problem especially since it would be inadvisable to spray. *R. lacustre* and *R. laxiflorum* exist in considerable profusion.

In general, timber stands are so dense as to have practically no Ribes except on streams. However, the area constituting the Silver Forest and immediately surrounding acreage, having been opened up by burns, offers a most difficult problem. About one-half of this area is practically free of Ribes. About 100 acres of it on the northwest facing slope, bordering Nisqually River and the Glacier snout, have abundant Ribes of all three species scattered through a reproduction stand. Here topography is severe and working conditions very difficult.

In order to protect both white pine areas described above, it would be necessary to work streams lying between since the distance between the stands, from their outer boundaries nearest each other, is only a mile or thereabouts.

The White River entrance to the Park should become very popular for tourists with the completion of improvements now under way. At only two points does white pine exist in sufficient quantities, to make protection desirable. These areas are located on White River, both on the northwest side. One area of about fifty acres is located 2½ miles up the river from the entrance toward the White River Camp. White pine makes up about 30 per cent of the stand and is probably around 60 years of age. The other area is at the upper camp. It is an area of perhaps fifteen or twenty acres of almost pure white pine about 60 years of age.

Ribes conditions are somewhat comparable on both areas except that *R. bracteosum* is not found within one mile of the upper one. A protection zone of 1/4 mile would probably be sufficient. At the lower area *R. bracteosum* would have to be pulled for a mile each way. There are Ribes only on the streams and draws and along a wide belt bordering White River on the flats. On these flats moist and sometimes swampy conditions prevail, resulting in heavy Ribes growth. Especially *R. lacustre*, *Grossularia divaricata*, *R. bracteosum*, *R. laxiflorum*, and *R. sanguineum* were found on the White River side of the park.

An estimate of the cost of protecting the various areas is shown below:

ESTIMATED COST OF PROTECTION AT LONGMIRE SPRINGS:

Class B	-	67.0 acres	@	$ 2.00	=	$ 134.00
Class C	-	79.1 "	@	3.00	=	237.30
Class D	-	115.8 "	@	7.00	=	810.60
Class D+	-	62.9 "	@	20.00	=	1,258.00
Class L	-	1.0 "	@	50.00	=	50.00
Class M	-	11.4 "	@	125.00	=	1,425.00
Total Cost					=	$3,914.90
Add 20% to cover small streams and small areas which may have been missed						728.60
						$4,697.50
Recommend for job						$4,700.00

ESTIMATED COST OF PROTECTION AT WHITE RIVER CAMP AREA:

An area one-half mile long by about one-fourth mile in depth extending along the White River road, beginning at a point about two miles southwest of White River entrance and extending toward White River Camp. To protect this area it would be necessary to work only stream type and swampy and open areas along the flats bordering White River. Ribes bracteosum should be pulled for a distance of one mile each way from the pine area. Other Ribes need only be eradicated to a distance of one-half mile. This would necessitate eradication of all Ribes from about 90 acres, which would average Class D at $6.00 per acre. Eradication of R. bracteosum outside the one-half mile radius and within the one-mile radius would necessitate covering an additional area of 30 acres averaging Class C at $4.00 per acre.

The total cost for protecting the area would be:

Class D	-	90 acres	@	$ 6.00	=	$540.00
Class C	-	30 acres	@	4.00	=	120.00
Total cost of job					=	$660.00

ESTIMATED COST OF PROTECTION AT UPPER WHITE RIVER AREA:

An area about one mile long by four chains wide would have to be worked on the side of the river on which the white pine is located. On the opposite side a strip one-half mile long by 2 chains wide would be sufficient. The total area to be worked is 38 acres. Ribes conditions are severe. Estimated cost is:

Class D - 38 acres @ $10.00 = $380.00

The total of these estimates is $5,740.00

SCOUTING FOR BLISTER RUST IN WASHINGTON, 1928

by

H. N. Putnam, Associate Pathologist.

INTRODUCTION

The only scouting for blister rust done in Washington, properly charged to that project, was that done in May, 1928, in the counties of Pend Oreille, Stevens and Spokane. A small amount of scouting was performed in those portions of streams originating in Washington and flowing into the Priest River drainage of Idaho. In addition, some scouting was done in Ferry and Okanogan counties, and on the east slopes of the Cascades on a trip made by Putnam and Joy when they were looking for areas suitable for the study of spread of infection from *Ribes lacustre* to white pine.

No mention is made in this report of methods and organization of work. For those seeking such information reference is made to "Scouting for Blister Rust in Idaho, 1928".

I. Results

A. Spring Scouting.

Table No. 1 gives the results of scouting for pine infection done in May.

TABLE NO. 1

RECORD OF SCOUTING FOR PINE INFECTION, EASTERN WASHINGTON, MAY 10 to 26, 1928.

County	Region	Number Pines Examined	Number Pines Infected
Pend Oreille	Ione and vicinity	100	0
Stevens	Colville and vicinity	305	0
Spokane	Newman Lake and vicinity	8,902	11
Total		9,307	11

The majority of the pines inspected were associated with *R. petiolare* or *Grossularia inermis*. A large number of pines inspected, however, were associated with *R. viscosissimum* or *R. lacustre*. No inspection was made of the Ribes bushes owing to the fact that it was too early in the season for the rust to appear on Ribes.

B. Summer Scouting.

In Table No. 2 is shown a record of inspection of host plants made in eastern Washington during the summer of 1928.

TABLE NO. 2

RECORD OF SCOUTING FOR BLISTER RUST IN WASHINGTON EAST OF THE CASCADE SUMMIT, SUMMER 1928

County	Infection Points	Ribes Species Examined																White Pine Exam.			
		R. bract.		R. petiol.		R. laxif.		G. watson.		G. inerm.		R. viscos.		R. lacus.		Total		P. monti.		P. albic.	
		Exam.	Inf.	Exam.	Inf.	Exam.	Inf.	Exam.	Inf.	Exam.	Inf.	Exam.	Inf.	Exam.	Inf.	Exam.	Inf.	Exam.	Inf.	Exam.	Inf.
Chelan	1	70	0	284	0	163	0	406	2	25	0			67	0	1,015	2	1,566	0		
Ferry	1			195	1					83	0	27	0	14	0	319	1			575	0
Okanogan				200	0							35	0			235	0	500	0	300	0
Pend Oreille										680	0					680	0	250	0		
Total	2	70	0	679	1	163	0	406	2	788	0	62	0	81	0	2,249	3	2,316	0	875	0

1928 Annual Report
H. N. Putnam

C. Infections Found in Washington, 1928.

In Table No. 3 is given a summary of all infections found in 1928. The infections reported from counties west of the Cascades were discovered during spring and fall trips in connection with plot study work.

TABLE NO. 3

BLISTER RUST INFECTIONS FOUND IN WASHINGTON
1928

County	Region	T.	R.	Sec.	Host Infected	Number Examined	Number Infected	Details Infection. Per Cent Leaves or No. Cankers and Year Wood	* Pine Association	Situation Infected Bushes	Inspector	Date	Remarks
Spokane	Newman Lake	26N	45E	5	P.monticola	1204	11	21 cankers 1923 infection	Excellent		MacLeod & Office Force	5/10 to 5/20	This area to be made into study plot.
					G.inermis	40	35	10% to 95%		In shade of Alders in swamp	Putnam & others	Aug.	
					R.lacustre	8	2	25%					
Pend Oreille	6 mi. probably west of Ione.	?	?	?	R.viscosissimum	20	1	15 leaves	?	?	Dr.Hedgcock (Ofc. of F.P.)	8/23	
Ferry	Dr.Russells Duck Pond near divide on Hall Cr.Road E.of Republic	35N	34E	NE 4 16	R.petiolare	5	1	5%	Very poor	In open border of pond	Joy Putnam	7/20	P.albicaulis on Edds Mt. 1¼ mi. N. of this spot. Elev. about 5500 feet.
Chelan	Willow Cr.1.9 mi. E. of and below Royal Development Co. to mine on Upper Chiwawa River.	30N	16E	35	G.watsoniana	402	2	2%	Excellent	On dry site in shade of mixed coniferous deciduous stand.	Putnam Joy	8/3	Many young and old pines in close association. R.petiolare, R.laxiflorum & R.lacustre abundant, but no infection found on them.
Whatcom	Stetattle Cr. Upper Skagit River ½ mi.below Reflector Ranger Station.	38N	13E	30-31	P.monticola	40	25	Many cankers per tree. Infected first in 1917.	Excellent		Putnam Spaeth	5/26	Canker on 1 tree 5" D.B.H. entered trunk 7½" from ground by means of tassel of foliage. Branches on lower half tree killed by blister rust.
	Thunder Lake, Upper Skagit River.	37N	13E	9	P.monticola	90	52	Many cankers per tree. Infection of 1922 origin.	Excellent		Putnam Spaeth	5/25	Infected pines along shore of lake. R. bracteosum abundant near outlet but many infected pines found ½ mi. away.
Island	Oak Harbor, 6 mi. north of town.	33N	1E	11	P.monticola	50	3	3 cankers. Infection 1922 origin.	Very good		Putnam Spaeth	5/27	11 R. nigrum found. 3 infected over 2% on 8/22/22 and destroyed 9/13/22. White pine within 150' infected probably from these black currants.
King	University of Washington campus near Forestry Bldg., Seattle	Seattle			R.nigrum	9	3	10%	Excellent	Planted in rows. Dry.	Putnam	10/20	Row of P.strobus within 40' of infected R. nigrum. No infection found here in 1927.
	Scenic, Snoqualmie N.F. 10 mi. W. of summit.	26N	13E	29	R.bracteosum	73	23	50%	Excellent	In open dry site but near stream.	Putnam Joy	7/31	Pines not showing infection in July. Infected pines adjoining infected R.bracteosum.
					P.monticola	10	2	2 - 1926				10/8	

*By "Pine Association" is meant the distance from infected Ribes to pines according to the following legend:
Excellent - Pines within 100 feet.
Very good - Pines 101 to 250 feet distant.
Good - Pines 251 to 500 feet distant.
Fair - Pines 501 to 1,000 feet distant.
Poor - Pines 1,001 to 1,500 feet distant.
Very Poor - Pines over 1,500 feet distant.

II. Costs

In Table No. 4 is shown the costs of scouting for blister rust in Washington.

TABLE NO. 4

COSTS OF SCOUTING FOR BLISTER RUST IN WASHINGTON, 1928

Name	Salaries	Subsistence	Transport.	Equipment	Total
Putnam, Joy and Office Personnel	$1,387.50	$34.20	$37.32	$12.62	$1,471.64

In the "Salaries" column is shown only the total amount of salaries for Putnam and Joy chargeable to this project. The salaries of other members of the office doing scouting work during the spring in Washington were charged to their respective projects.

The subsistence item of $34.20 is that of the men engaged in scouting during the spring.

The transportation item of $37.32 is composed entirely of costs of gas, oil, and minor repairs of government trucks used in the spring scouting.

The equipment item of $12.62 is made up of $5.00, the field and technical equipment depreciation of the entire office prorated to this project, plus a charge of $7.62 for map prints for use on this project.

No attempt is made to make any analysis of these cost data, because much of the time and cost were contributed by other projects.

III. Conclusions

Scouting in Washington in 1928 was not performed on a scale sufficiently large to justify drawing definite conclusions as to the extent of blister rust in the State. We know from previous experience that the rust is generally prevalent west of the Cascades.

On the east slopes of the Cascades the rust was found much less abundant than was believed to be the case. No pine infection was located, and only a small amount of Ribes infection.

In northeastern Washington, in the extreme western portion of the Inland Empire white pine belt, a small amount of Ribes infection was found. It is believed that here infection conditions resemble those found in the Idaho white pine region.

BLISTER RUST CONTROL WORK IN OREGON
1928

Blister rust control work in Oregon was carried on, as in the past, as a cooperative project between the Oregon State Board of Horticulture, Oregon State Board of Forestry, Oregon State College and the Bureau of Plant Industry. The basic memorandum of understanding upon which this work was organized was made effective July 1, 1927 and can be found in the report for that calendar year. The following is the amendment to this memorandum to cover the work as organized for the Federal fiscal year 1929, beginning July 1, 1928:

"AMENDMENT TO
MEMORANDUM OF UNDERSTANDING
Effective July 1, 1927

Between
THE UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY
and the
OREGON STATE BOARD OF HORTICULTURE - - - OREGON STATE BOARD OF FORESTRY - - - and the OREGON STATE COLLEGE.

Cooperative Work in Controlling White Pine Blister Rust in OREGON.
* * * *

"Paragraph E-6 of the Memorandum of Understanding described above contains the following:

> "'For the Fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $16,000 to the support of the cooperative work, and the Oregon State Board of Horticulture approximately $14,250, the Oregon State Board of Forestry approximately $7,000, and the Oregon Agricultural College shall contribute in value approximately $1,500; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence.'

"In accordance with the foregoing provision, it is mutually agreed that for the fiscal year ending June 30, 1929 there will be expended by the Oregon State Board of Horticulture approximately $14,250.00, by the Oregon State Board of Forestry approximately $7,000.00, by the Oregon State College approximately $1,500.00, and by the United States Department of Agriculture, Bureau of Plant Industry, through its Office of Blister Rust Control, approximately $11,100 in connection with

cooperative blister rust control work in Oregon.

Date:		Signature:
7/12/28	(s)	Chas. A. Parker President, Oregon State Board of Horticulture.
7/12 1928	(s)	F. A. Elliott State Forester, Oregon State Board of Forestry.
7/10/28	(s)	H. P. Barss Plant Pathologist, Oregon State College.
Aug 1 1928	(s)	K. F. Kellerman Chief, Bureau of Plant Industry."

BLISTER RUST CONTROL WORK IN OREGON, 1928

by
L. N. Goodding,
Associate Pathologist.

EDUCATIONAL WORK.

The educational work this year has been confined to correspondence with Fire Wardens, County Fruit Inspectors, Forest Service Officials, and those asking for information. Letters, circulars, and "Questions and Answers" were sent to about 500 Fire Wardens and a similar number of Forest Service Officials. Colored posters were sent to all Forest Service Officials.

Several talks were made on blister rust, although no definite speaking program was arranged. On June 11 about 75 Forest Service men were addressed at the Forest Service School at Palmer, Oregon and on June 21 a similar number were addressed at Hemlock, Washington. On July 12 a talk was made to the Western Plant Quarantine Board in Salem, Oregon. By request, coming via Lachmund's office, a talk was given in the U. S. Grant High School in Portland, Oregon to a group of science students.

Some blister rust material and about 30 Ribes keys have been distributed to Fire Wardens, Forest Service Officials and teachers.

For copy of the "Questions and Answers", see 1927 report. The map was slightly revised to show the spread of blister rust.

Oregon State College
Corvallis, Oregon
July 30, 1928.

Mr. E. W. McMindes,
County Agent,
Astoria, Oregon.

Dear Mr. McMindes:

I am sending you a few copies of our revised "Questions and Answers" about blister rust, a list of the places where blister rust has been found in Oregon, and a circular recently provided us by the Washington office. If the curious of your county ask questions about blister rust not answered in this literature, I wish you would refer them to me. I shall be glad to try to answer any questions you may ask.

Thanking you for your cooperation, I am

Yours very truly,

Leslie N. Goodding,
Associate Pathologist

(28 copies)

COPY OF THIS LETTER SENT TO

ALL COUNTY AGENTS IN OREGON.

SIMILAR, BUT NOT IDENTICAL,

LETTER SENT TO ALL COUNTY

FRUIT INSPECTORS IN OREGON.
(24 copies)

UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Plant Industry

In Cooperation with
THE OREGON STATE BOARD OF FORESTRY

Office of Blister Rust Control
Oregon State College
Corvallis, Oregon

(360 copies of this letter mailed)

Dear Sir:

I have talked over the white pine blister rust situation in Oregon with Mr. Elliott, and he has asked me to send you a list of "Questions and Answers" about the disease. This you should receive within a few days.

On the accompanying page is a list of the places where blister rust has been found in Oregon, together with the dates of location, host plants, and the names of those who did the scouting. From this you will notice that blister rust was not found on pines in Oregon until this year, but that it has been found in a great many places on currants. Owing to the ability of the rust to spread long distances from diseased pines by wind-blown spores, we may confidently expect a wave of the disease to the south and east from the Mt. Hood region in the next two or three years. The first evidence of its presence in new territory, of course, will be found on the currants or gooseberries.

At first thought there seems to be no significance to currant infections in Clatsop, Columbia and Tillamook Counties, but this is hardly true. The cultivated white pines in Astoria, the scattering white pines in the Wilson River region in Washington and Tillamook counties, the planted white pines on Mt. Hebo, and the more extensive stands of native white pines in western Polk and eastern Lincoln counties make possible the establishment of the disease on pines in the coastal region any season. Once these pines are infected and shooting spores we can expect a wave of the rust far to the south of its present known limits.

Intensification of the rust on pines in the Mt. Hood region will be followed by a wave of the disease further south in the Cascades and possibly to the Blue and Wallowa mountains in northeastern Oregon.

I am sure you will keep a weather eye open for any appearance of the rust in your region. It is much easier to find it on the currants

than on the pines from now on until fall. The cultivated black currant is more susceptible than any of the other currants or the gooseberries, following this are our two native black currants, the wild stink currant common along streams west of the Cascades and the wild black currant to be found along many streams east of the Cascades.

If you find anything you think is blister rust, please send me a specimen while the matter is fresh on your mind. If you are interested in the currants and gooseberries of your region, I shall be glad to send you a small illustrated key to the Ribes of Oregon. Thanking you for your cooperation, I am,

Very truly yours,

Leslie N. Goodding
Associate Pathologist

UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Plant Industry

Department of Botany
Oregon State College
Corvallis, Oregon

(150 copies of this letter mailed)

Dear Sir:

With the consent of Mr. Granger, I am sending you under separate cover one of our revised Blister Rust Posters and a set of "Questions and Answers" about white pine blister rust. After visiting many of the rangers in the field I realize that all of the Forest Service men have a lively interest in this subject.

On the accompanying page is a list of the places where blister rust has been found in Oregon, together with the dates of location, host plants, and the names of those who did the scouting. From this you will notice that blister rust was not found on pines in Oregon until this year, but that it has been found in a great many places on currants. Owing to the ability of the rust to spread long distances from diseased pines by wind-blown spores, we may confidently expect a wave of the disease to the south and east from the Mt. Hood region in the next two or three years. The first evidence of its presence in new territory, of course, will be found on the currants or gooseberries.

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If you find anything you think is blister rust, please send me a specimen while the matter is fresh on your mind. If you are interested in the currants and gooseberries of your region, I shall be glad to send you a small, illustrated key to the Ribes of Oregon. Thanking you for your cooperation, I am,

Yourstvery truly

Leslie N. Goodding
Associate Pathologist

TABLE NO. 1

BLISTER RUST INFECTIONS IN OREGON

Location	Host	Date	Inspector
1925			
Pacific City, Tillamook Co.	Cultivated Black Currant	9-22	Goodding & Edmunds
Gnat Creek near Knappa, Clatsop Co.	Wild Stink Currant	9-24	Mallery & Drew
Wheeler, Tillamook Co.	Wild Stink Currant	9-29	Goodding & Patty
1927			
Eagle Creek, Hood River Co. 3 mi. east of Bonneville	Wild Stink Currant	9-17	Goodding & Stone
Tanner Creek, Multnomah Co. 1/4 mi. s.e. Bonneville	Wild Stink Currant	9-21	Goodding, Stone & Walker
Moffett Creek, Multnomah Co. 2 mi. south Bonneville	Wild Stink Currant	9-21	Goodding, Stone & Walker
Beaver Creek, Columbia Co. 3 places 2-mile radius, about 5 mi. east Clatskanie	Wild Stink Currant	9-22 10-7	Stephens, Gray Goodding & Joy
Gordon Creek, Multnomah Co. 5 mi. s.e. Springdale	Wild Stink Currant	9-23	Stone
Deverell and Burkhalder Ranches Multnomah Co., near Corbett	Cultivated Black Currant	9-23	Stone & Goodding
Herman Creek, Hood River Co. 7 mi. s.e. Cascade Locks	Wild Stink Currant	9-30	Goodding
Saddle Mt. 1 mile west, 8 mi. n.e. Necanicum	Wild Stink Currant	10-12 10-12	Edmunds & Robertson
Saddle Mt. 4 mi. n.e., 13 mi. n.e. of Necanicum	Wild Stink Currant	10-12	Edmunds & Robertson
Necanicum River 4 mi. east of Necanicum	Wild Stink Currant	10-14	Edmunds & Robertson

TABLE NO. 2.

1928 - Blister Rust Infection on Pines

About 2 mi east of Palmer, Multnomah Co.*	Western White Pine	5-30	Goodding

*Two infected trees were found. One canker was found on one tree and four on the other. On May 31 Stansbery, Bozarth and Goodding found two cankers on one of the same two trees. All cankers fruited for the first time in 1928. All cankers were removed.

WIND RIVER NURSERY

The preliminary inspection work on this Nursery was done by Edmunds, Strong and Goodding on November 27-28, 1927 and their report was included in last year's report. It is in order to call attention to some matters of fact. The preliminary scouting failed to reveal the true condition along Trout and Martha Creeks, particularly. Martha Creek and its tributaries proved to be well grown up to Ribes bracteosum, and Trout Creek had a liberal scattering of this species. The slope above the nursery also yielded many times the number of Ribes sanguineum thought to be present at the time the first inspection was made. It must be remembered, however, that the preliminary work was done at a time when Ribes bushes were practically or completely defoliated and the true condition was not evident. On the whole, however, the job was, as revealed by the initial survey, a comparatively simple undertaking.

On May 3-4, 1928, Painter, Peterson and Goodding did the preliminary eradication work. At this time Ribes sanguineum was in excellent flower. The following tabulations show the results of the eradication:

NO.

ERADICATION IN THE 1500 FOOT ZONE, BY PETERSON, PAINTER AND GOODDING, MAY 3-4, 1928

Species	No. Bushes	Av. Ht. Feet	Feet Live Stem	Av. Feet Live Stem	Feet Dead Stem	Ft. New Growth
R. sanguineum	141	3.49	5,441.75	38.59	1,036.5	-
R. odoratum*	10	2.9	553.5	55.35	5.	1
Total	151	3.45	5,995.25	39.77	1,041.5	1

*Introduced several years ago and cultivated as an ornamental.

On June 16 a crew of six men with E. M. Hornibrook as camp boss began the systematic eradication of the mile zone about the nursery. Hornibrook took a position with the Forest Service, leaving our office June 30. Upon his resignation Kenneth W. Gray was made camp boss. Owing to the great abundance of Ribes bracteosum, and the loss of the camp boss which left us short-handed so early in the season, the work was continued much longer than was at first expected. The final clean-up was not completed until July 21.

The following table shows the Ribes eradicated. A very few Ribes sanguineum bushes were found in the course of the scouting and were eradicated as it was little trouble to do so. A glance at the map will show the concentrations of R. bracteosum and R. sanguineum in the entire area:

TABLE NO. 4

ERADICATION OUTSIDE THE 1500 FOOT ZONE BUT WITHIN THE MILE ZONE JUNE 18 - JULY 21 INC.1928

Species	No. Bushes	Av. Ht. Feet	Feet Live Stem	Av. Feet Live Stem	Feet Dead Stem	Ft. New Growth
R. bracteosum	6,058	1.51	40,777.5	6.73	8,463.3	8,648.5
R. Sanguineum	25	4.38	762.5	30.5	134.	135.3
Total	6,083	1.52	41,540.	6.83	8,597.3	8,783.8

TABLE NO. 5

ERADICATED WITHIN THE 1500 FOOT ZONE JULY 20-21 1928

Species	No. Bushes	Av. Ht. Feet	Feet Live Stem	Av. Feet Live Stem	Feet Dead Stem	Ft. New Growth
R. sanguineum	6	2.0	105	17.5	20	32.5

TABLE NO. 6

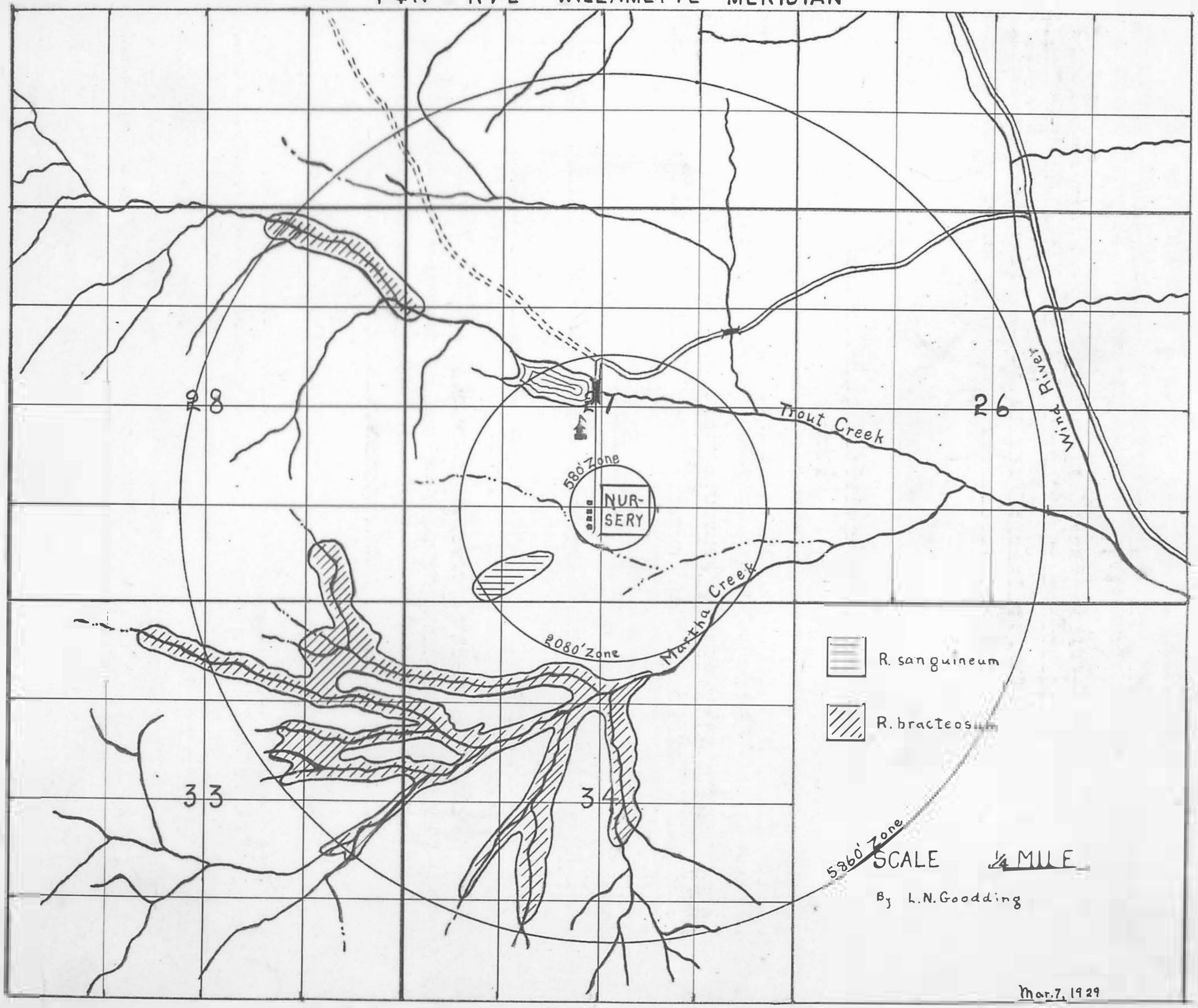
TOTAL NUMBER OF RIBES ERADICATED BY SPECIES

Species	No. Bushes	Av. Ht. Feet	Feet Live Stem	Av. Feet Live Stem
R. bracteosum	6,058	1.51	40,777.5	6.73
R. sanguineum	172	3.57	6,309.25	36.68
R. odoratum	10	2.90	553.5	55.35
Total of all Species	6,240	1.45	47,700.35	7.64

In the latter part of June Mr. Evinger examined the ground where bushes were pulled by Painter, Peterson and Goodding, and found that many new seedlings were coming on. These were not eradicated, it being thought best to leave them until they were slightly more visible. A newly graded road also offers an excellent opportunity for Ribes to come as a result of soil disturbance.

See recommendations and acknowledgments at the close of the Oregon report.

NURSERY SANITATION, WASHINGTON
T4N - R7E WILLAMETTE MERIDIAN



WIND RIVER EXPERIMENT STATION AREA

ERADICATION IN THE STILL CREEK AREA

For description of the site and general conditions in the region, see the annual report for 1927.

The work on this area was started in 1927 and resumed July 24, 1928. The nature of the ground to be covered permitted the division of the crew into a scout crew of two and sometimes three men and the regular crew for stream type work. Some time after the work started Lund and Woodside were called in from the ecology work and put on scout eradication. The scout crew covered the steep, dry slopes and mapped out the small streams with abundant Ribes for the main crew. The following table gives the results of each crew by months, and a summary of the season:

TABLE NO. 7

JULY 24-31 STILL CREEK, OREGON

Method	Species	No. Bushes	Av. Ht.	L. S.	Av. L. S.	Dead Stem	New Growth
Crew	R. bracteosum	473	2.28	5,247.2	11.09	382.7	1,209.1
	R. lacustre	544	1.72	9,734.5	17.89	911.8	1,180.8
	R. triste	23	1.85	144	6.26	0	36.3
Total		1,040	1.98	15,125.7	14.54	1,294.5	2,426.2
Scouts	R. sanguineum	208	3.14	18,780.	90.29	797	1,149.
	R. lacustre	27	1.13	469.	17.37	61	51.5
Total		235	2.91	19,249.	81.91	858	1,200.5
Total Ribes by Species	R. bracteosum	473	2.28	5,247.2	11.09	382.7	1,209.1
	R. lacustre	571	1.69	10,203.5	17.87	972.8	1,232.3
	R. sanguineum	208	3.14	18,780.	90.29	797.0	1,149.0
	R. triste	23	1.85	144.	6.26	0	36.3
GRAND TOTAL		1,275	2.15	34,374.7	26.96	2,152.5	3,626.7

TABLE NO. 8

AUGUST 1-31, STILL CREEK, OREGON

Method	Species	No. Bushes	Av. Ht.	Live Stem	Av. L. S.	Dead Stem	New Growth
Crew	R. lacustre	4,363	2.00	101,630.5	23.30	13,523.5	10,201.7
	R. bracteosum	1,893	2.39	41,039.2	21.68	3,851.1	6,819.0
	R. sanguineum	13	3.69	947.5	72.88	14.0	95.2
Total		6,269	2.14	143,617.2	22.91	17,388.6	17,115.9
Scouts	R. sanguineum	529	2.70	31,309.	59.19	3,267.	3,024.5
	R. lacustre	57	2.12	2,400.	42.11	751.	376.0
	R. viscosissimum	3	3.67	168.	56.00	4.	5.0
Total		589	2.65	33,877.	57.52	4,022.	3,405.5
Total Ribes by Species	R. lacustre	4,420	2.00	104,030.5	23.54	14,274.5	10,577.7
	R. sanguineum	542	2.72	32,256.5	59.51	3,281.0	3,119.7
	R. bracteosum	1,893	2.39	41,039.2	21.68	3,851.1	6,819.0
	R. viscosissimum	3	3.67	168.0	56.00	4.0	5.0
GRAND TOTAL		6,858	2.32	177,494.2	25.88	21,410.6	20,521.4

TABLE NO. 9

SEPTEMBER 1-11, STILL CREEK, OREGON

Method	Species	No. Bushes	No. Av. Ht.	Live Stem	Live Av. L. S.	Dead Stem	New Growth
Crew	R. lacustre	855	1.98	21,548	25.20	714	2,722.4
	R. bracteosum	91	3.07	4,689	51.53	373	576.
	R. sanguineum	6	5	1,440	240.0	12	179.
Total		952	2.10	27,677	29.07	3,099	3,477.4
Scouts	R. sanguineum	152	3.04	7,966	52.41	455	633
Total Ribes by Species	R. lacustre	855	1.98	21,548	25.20	2,714	2,722.4
	R. bracteosum	91	3.07	4,689	51.53	373	576
	R. sanguineum	15.8	3.11	9,406	59.53	467	812
GRAND TOTAL		1,104.	2.23	35,643	32.29	3,554	4,110.4

TABLE NO. 10

SUMMARY SHEET FOR CREW AND SCOUTS
JULY 24-31, AUGUST 1-31, SEPTEMBER 1-11.

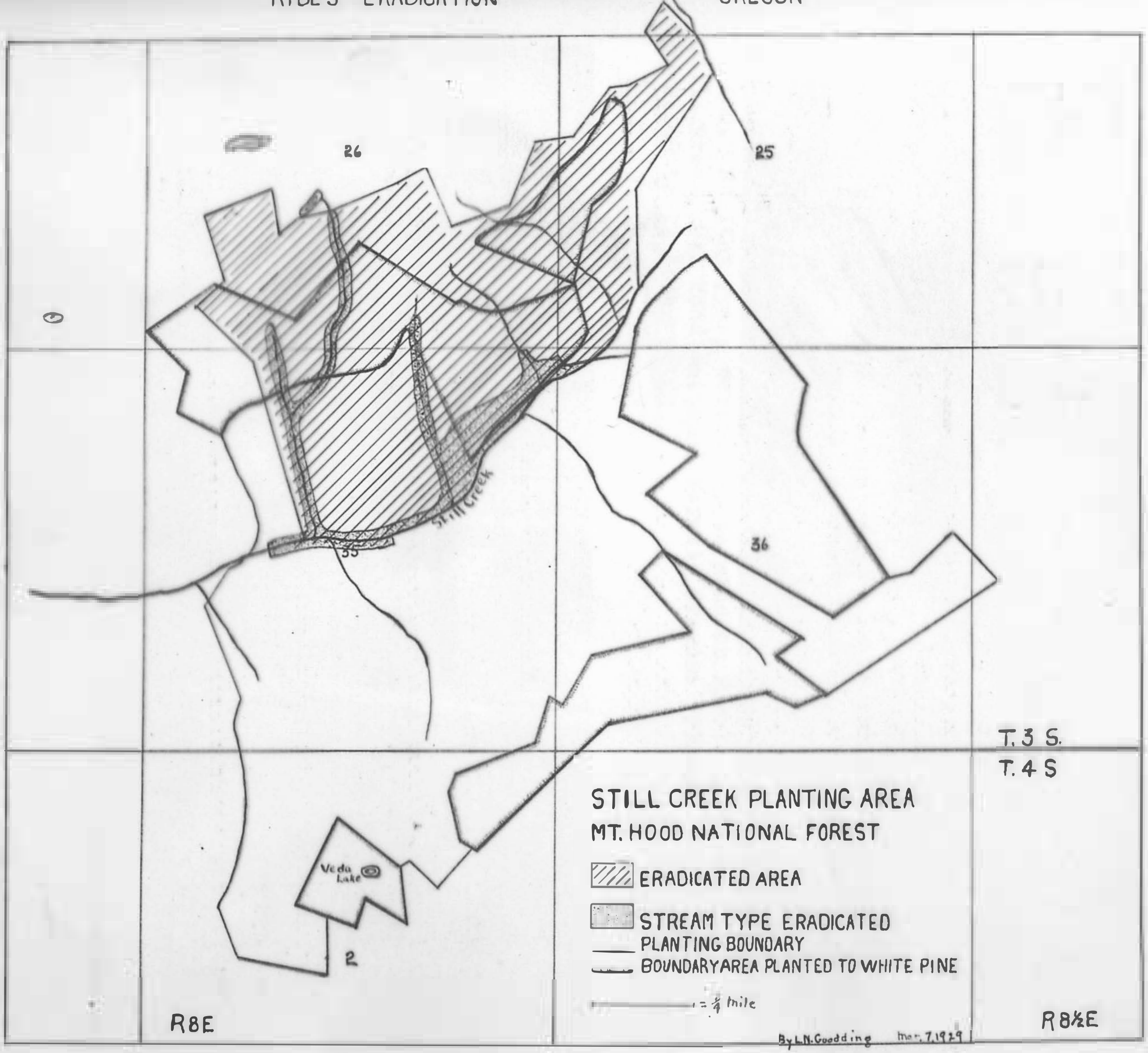
Method	Species	No. Bushes	Av. Ht.	Live Stem	Av. L. S.	Dead Stem	New Growth
Crew	R. bracteosum	2,457	2.39	50,975.4	20.75	4,606.8	8,604.1
	R. lacustre	5,762	1.97	132,913.0	23.07	17,149.3	14,104.9
	R. triste	23	1.85	144.0	6.26	0.0	36.3
	R. sanguineum	19	4.10	2,387.5	125.66	26.0	274.2
Total		8,261	2.10	176,392.9	21.35	21,782.1	23,019.5
Scouts	R. sanguineum	889	2.86	58,055.0	65.30	4,519.0	4,806.5
	R. lacustre	84	1.80	2,869.0	34.15	812.0	427.5
	R. viscosissimum	3	3.67	168.0	56.00	4.0	5.0
Total		976	2.77	61,092.0	62.59	5,335.0	5,239.0
Total Ribes by Species	R. bracteosum	2,457	2.39	50,975.4	20.75	4,606.8	8,604.1
	R. lacustre	5,846	1.97	135,782.0	23.23	17,961.3	14,532.4
	R. triste	23	1.85	144.	6.26	0	36.3
	R. sanguineum	908	2.89	60,442.5	66.57	4,545.0	5,080.7
	R. viscosissimum	3	3.67	168.0	56.00	4.0	5.0
GRAND TOTAL		9,237	2.17	247,511.9	26.80	27,117.1	28,258.5

TABLE NO. 11

SUMMARY - STILL CREEK

Type	How Worked	Acres Covered	Species	Number Per Acre	Live Stem
Stream	Crew	50	R. bracteosum	49.14	1,019.5
			R. lacustre	115.2	2,658.3
			R. triste	.46	2.9
			R. sanguineum	.38	47.75
Open hillside	Scouts	408.3	R. sanguineum	2.18	142.0
			R. lacustre	.2	7.0
			R. viscosissimum	.007	.4
Totals		458.3	5 species		

RIBES ERADICATION OREGON



W. 456. Healthy young western white pine on Forest Service planting, Still Creek, Mt. Hood National Forest, Oregon. Planted 1918. Height of trees, 8 to 12 feet.

W. 459. 4-man crew and foreman pulling Ribes in stream type, Still Creek, Oregon. Associated brush, alder and rubus.

WORD OF EXPLANATION REGARDING STILL CREEK PLANTING AREA MAP

The map does not show the portion of the planting where Ribes eradication was done in 1927.

The outline of the planting area was copied from a Forest Service Reconnaissance map. The outlines of the eradication area are based on measurements made from section corners in the field. The planting actually extends out to the boundary of the eradicated areas. The Forest Service map apparently has not been corrected since this region was resurveyed.

The chemical eradication was done below Veda Lake in the southern part of the area. Discussion of this is contained in Offord's report on chemical eradication.

Reference to the accompanying map will show the area covered. The north bank of Still Creek has been covered through the planting and several of the streams running in from the north. At the upper end of the planting, however, there is much swampy land with an abundance of R. bracteosum and R. lacustre. A strip on the south bank of Still Creek has been covered from the upper end of the planting to a point opposite the planting cabin. Another small strip has been eradicated on the south bank at the lower end of the stream.

A small chemical eradication plot was laid out below Veda Lake. This is reported in Offord's discussions.

Much of the planting south of Still Creek has no white pine except at higher elevation and the lower half of the small streams can be ignored and much of the white pine stand cleaned up by scouts.

See recommendations at close of Oregon report.

ECOLOGICAL WORK

Two ecology crews began work at the same time the eradication work started at Wind River. Mr. Sipe and Mr. Lund did work in southern Oregon. They took notes on the ecology plots laid out in 1927, laid out some new plots, and did scouting to study Ribes conditions. Mr. Evinger and Mr. Woodside did similar work in northern Oregon. The last two men also made some studies in the region of the Wind River Nursery before going to Still Creek. As most of the plots* require some years of observation before final results can be obtained and as the records are kept by individual plots too detailed for this

*Plots with Ribes established in the Still Creek area will doubtless be destroyed next year because of the blister rust menace to the pines.

report, only some evident conclusions are given here. Mr. Sipe has written the report for southern Oregon. The conclusions given here are based on plot and scouting work done by Mr. Evinger.

One plot was established in a 1927 burn for the study of germination, and survival of seedlings of R. sanguineum. This species runs true to form, germinating readily after a light burn. On this particular plot, however, there was strong evidence of storage of the fruits probably by mice as some bunches of seedlings were masses of 150 or more individuals, and small nests under burned roots were evident.

Scouting near the nursery or ground where R. sanguineum has been eradicated in the spring revealed numerous seedlings in the disturbed area. From this it is evident that many new plants will be coming on here and along the road constructed during the summer.

Further observations on R. sanguineum in the Still Creek region showed that germination is not infrequent on the exposed slopes without special disturbance of the soil. Seeds, however, do not appear to germinate the first year, this species seldom if ever layers, and no rooting is likely where bushes are pulled and thrown on the ground. Exposed roots, left after eradication, seem never to grow new shoots, but exposed pieces of crown are prolific. Germination of fallen seed is greatly accelerated by soil disturbance, and survival of young seedlings is but a small per cent of those germinating.

Observations made on R. bracteosum on the plots and elsewhere show that this species reproduces readily by seed, these germinating in acid humus and partial shade, not dense shade, as well as in more open places with mineral soil; young plants spring up readily from broken layered branches, species of crown left exposed, branches dropped on the wet ground, and crowns left exposed by beavers. The species is extremely difficult to eradicate for these reasons. In the Still Creek area a disease, Ceriospora ribis, on R. bracteosum is quite prevalent which kills each season's growth and largely prevents reproduction. This disease is by no means confined to this region, but has been observed in the Wind River region and at the head of the Wilson River. The value of this disease as an "inhibitor" of R. bracteosum growth, however, is limited. It is most prevalent at higher elevation and in exposed places, apparently only attacking the plants which are already existing under difficulties. In the shade and the lower stream levels where R. bracteosum is prolific the disease does not occur. An experiment on a very small scale on inoculation of Ribes with this disease indicated that it can be thus transmitted but catches were light and the growth slow.

R. bracteosum awaits successful treatment with chemical sprays.

Some observations were made on the effects of sheep grazing on

Grossularia watsoniana and R. viscosissimum. The sheep grazed off most of the leaves and fruits, but the disturbance of the soil also seemed to aid germination. In the region where these observations were made the above named species are abundant, and in many places associated with pines. In the near future this will constitute an excellent ground for studying susceptibility of these species.

Each season extends our knowledge of the range of R. petiolare. The summer of 1928 revealed it on the heads of several of the streams in Wasco County and to the south as far as Tumalo Creek west of Bend. It is, of course, widely distributed in northeastern Oregon. To date it has not been found west of the Cascades, and the nearest approach being Ash Creek on the Mt. Hood Loop.

Professor W. E. Lawrence, E. L. Evinger and L. N. Goodding all reported G. nivea from Wasco County this year. The extreme susceptibility of this species makes it of possible importance in spite of its occurrence at low altitudes only.

Ribes triste is also proving to be prevalent in many localities in the Mt. Hood National Forest.

RIBES ECOLOGY IN SOUTHERN OREGON

The ecology work in southern Oregon for the 1928 season may be divided into the following types.

1. Plot studies, in which the plots established in 1927 were carefully checked, and some new plots established.

2. Extensive scouting, in which an effort was made to secure more accurate data on the extent and distribution of the various Ribes species of southwestern Oregon and the extent and nature of their associations with white pine species.

I. Plot Studies. The plots established late in the summer of 1927 were checked, both for possible results and for observing and repairing any damages to stakes, etc. Due to the lateness of their being established in 1927, plots showed no striking changes. The following may be assumed as fairly accurate conclusions from data secured on these plots.

(a) Ribes cereum is not killed by the average heavy burn, but the old stump sends up a mass of vigorous, new shoots the following spring.

(b) Grossularia klamathensis seed do not all germinate during one season following an eradication, but may be found germinating each year for several years.

(c) Seeds from buried fruits of one season do not germinate the following season (species G. lobbii, G. klamathensis, R. viscosissimum, G. binominata, G. cruenta, R. cereum.

(d) Light (duff) fire results in the production of a heavy growth of small annual and perennial plants, even where the overstory of shade remains the same, e.g., such genera as Clintonia, Galium, Linnea, Vancouveria, etc. No Ribes seedlings were found in these plots.

Six new plots (Nos. 13-18) were established.

No. 13. This plot is located on the trail between Union Creek and Woodruff Meadows, near the top of a south-facing slope, where the soil is shallow and stony, and the trees are scattered and small. twenty-two G. cruenta plants are included in the plot. Each plant was marked with a numbered tag and the following data taken on it: height, live stem, dead stem, new growth, number of fruits, shade.

No. 14. This plot is located near Mill Creek Meadows. It extends from the heavily burned section of an old burn, into the adjoining unburned area. This burn was followed by a very heavy invasion of R. sanguineum. The plot includes both burned and unburned areas, with data on shade, duff, growth, fruits.

No. 15. This plot is located in the unburned area near Plot 14. The heavy growth of R. sanguineum on Plot 13 would indicate that dormant seed were present in the duff before the fire. This plot was laid off and the duff dug up to mineral soil, thus imitating disturbance of logging operations. Plot to be checked for seedling Ribes.

No. 16. Located near Plot 15, in unburned area. Plot was treated the same as No. 15 (digging up of duff to mineral soil), and in addition as much as possible of the shading plants removed, thus increasing the light received, as compared with Plot 15. Plot to be checked for germinating Ribes.

No. 17. This plot is on an area of R. viscosissimum, in a typical R. viscosissimum habitat, where the Ribes plants are being rapidly overshadowed by growth of coniferous reproduction. Aim: to determine effects of encroaching reproduction on R. viscosissimum.

No. 18. This plot is on a typical R. erythrocarpum habitat. A small area was eradicated by hand pulling. Aim: to check on effectiveness of hand eradication on this species, and the germination of Ribes seeds that might be present in the disturbed surface soil.

II. Extensive Scouting. Below is a condensed list of areas scouted.

1. Union Creek Ranger Station (Crater National Forest) several miles in all directions.
2. East of Crater Lake, in Crater National Forest.
3. Beaver Marsh to Silver Lake, along the north edge of Fremont National Forest.
4. Silver Lake to Lakeview and Klamath Falls, along east and south edge of Fremont National Forest.
5. Klamath Falls to Ashland.
6. Ashland to Lake of the Woods, in southern part of Crater National Forest.
7. Upper Applegate River.
8. Grayback Mountain and Lake Mountain in Siskiyous.

Table No. 1 indicates graphically some preliminary data secured on the altitudinal distribution of different species of Ribes in southwestern Oregon. More complete and accurate data of this kind should be of value, when correlated with like data on the three species of white pine. Southern Oregon is rich in species of Ribes. Certain preliminary studies seem to indicate that some species of Ribes are seldom found associated with P. lambertiana, while other species would naturally deserve more careful study in preparing a program for blister rust control in this area.

Recommendations for 1929

1. Careful checking of all ecology plots already established.
2. New plots:
   (a) In a R. viscosissimum - P. monticola area (Huckleberry Mountain or other) to study habits of growth, reproduction, shade tolerance, etc., of R. viscosissimum.
   (b) In a R. erythrocarpum area, to start further studies on growth habits, shade tolerance, reproduction of this species. (Huckleberry Mountain).
   (c) In a G. binominata area, to secure like data on this species.
   (d) Plot to try out chemical eradication on R. erythrocarpum. Preliminary studies indicate that hand eradication would prove very unsatisfactory with this species. R. erythrocarpum occurs associated with the alpine species, P. albicaulis, and also with P. monticola.

3. Further extensive scouting to secure data on:

(a) Vertical or altitudinal distribution of the different species of Ribes and white pine.

(b) Typical habitat of each species of Ribes and its relation to white pine habitat.

4. Ecological studies in Crater National Park. The Park Superintendent has requested that this work be done (See letter in complete report from Col. E. G. Thomson, Supt. of Park). The actual amount of white pine (P. monticola and P. albicaulis) in the park is small, but the park service is particularly anxious to have all precautions taken to protect these for three reasons:

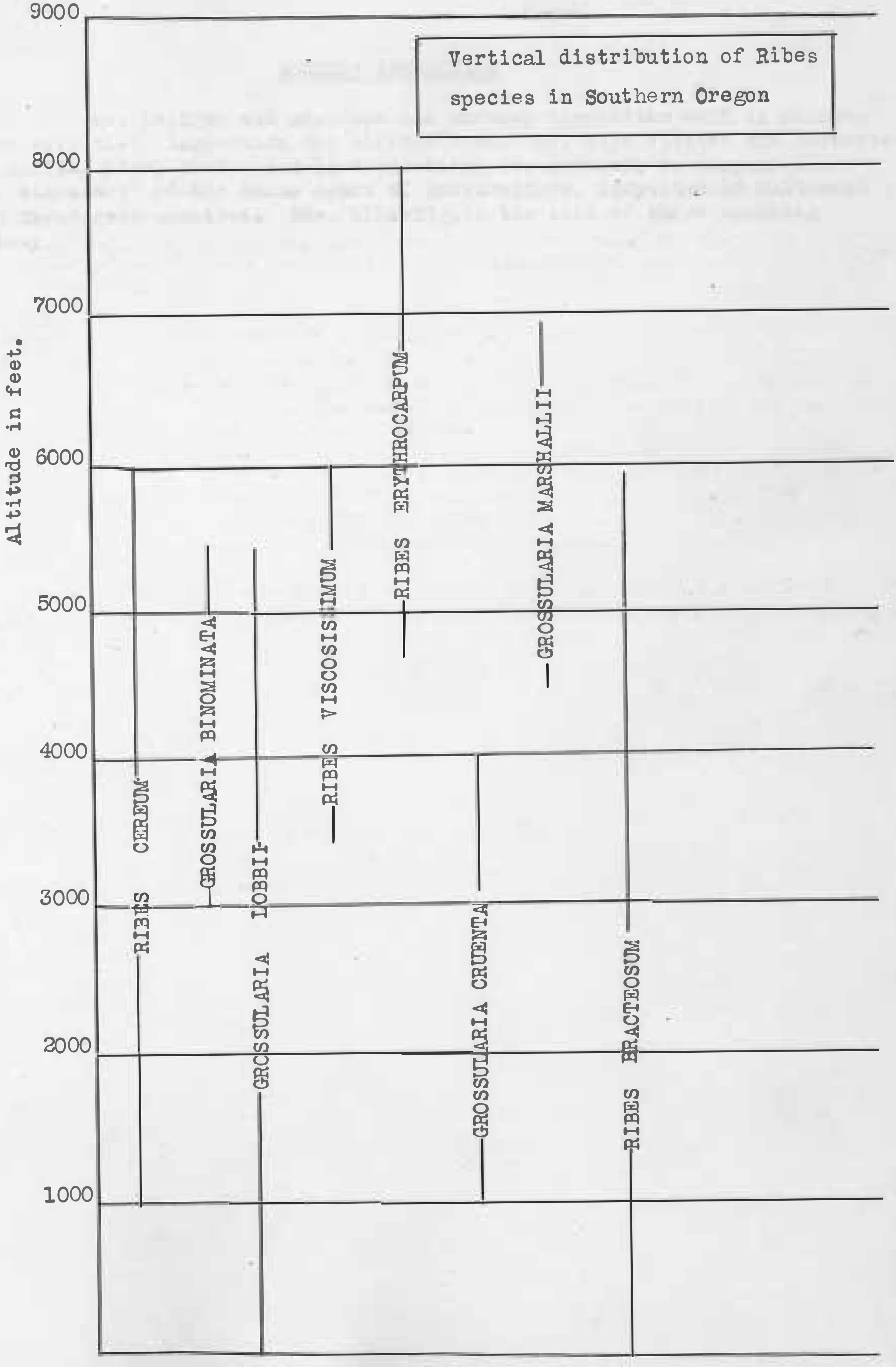
(a) Because of their beauty. They are prized most highly of all trees in the park.

(b) P. albicaulis occupies many high and relatively barren ridges. Its destruction would mean the complete denudation of these places.

(c) Col. Thomson thinks that observations he has made in the Park indicate that in many places the present forest is not the climax stand, but that under modern fire protection there is a strong likelihood that P. monticola may become increasingly abundant.

5. Plots 14-15-16 should be supplemented by a plot in the same locality in which the duff is burned, other conditions remaining the same.

TABLE NO. 12


Vertical distribution of Ribes species in Southern Oregon
Altitude in feet.
9000
8000
7000
6000
5000
4000
3000
2000
1000
RIBES CEREUM
GROSSULARIA BINOMINATA
GROSSULARIA LOBBII
RIBES VISCOSISSIMUM
RIBES ERYTHROCARPUM
GROSSULARIA CRUENTA
GROSSULARIA MARSHALLII
RIBES BRACTEOSUM

NURSERY INSPECTION

Mr. Evinger and Mr. Sipe did nursery inspection work in connection with their inspection for blister rust. Mr. Sipe visited the nurseries in Marion, Linn, Benton and Lane counties, Mr. Evinger, in company with Mr. Stansberry of the State Board of Horticulture, inspected in Multnomah and Washington counties. The following is the list of those handling Ribes:

TABLE NO. 13

Nursery	Location & Co.	Inspector	Date	No. currants	No. gooseberries	No. Pine	Remarks
Russellville	Portland, Mult.	Evinger & Stansberry	10-15	325	5	0	Probably gets plants elsewhere
Villa	Portland, Mult.	Evinger & Stansberry	10-15	Several	Several	0	Formerly handled many, gone out of Ribes business
Portland Wholesale Nur. Co.	Portland, Mult.	Evinger & Stansberry	10-17	23,000	0	0	
Carlton	Carlton, Yamhill	Evinger & Stansberry	10-16	Few	1,500	0	
Brooks	Lafayette Yamhill	Evinger & Stansberry	10-16	0	0	0	Handle Ribes but get them elsewhere
Lafayette	Lafayette Yamhill	Evinger & Stansberry	10-16	0	0	0	Handle Ribes but get them elsewhere
Oregon Nur. Co.	Orenco, Wn.	Evinger & Stansberry	10-16	850	0	Several	Pines are ornamentals 1500 ft. or more from currants
Hudson Nur. Co.	Tangent, Linn.	Sipe	9-7	300	2,000	0	Not quarantined territory
Woodruff Nursery	Eugene, Lane	Sipe	9-7	400	0	0	Not quarantined territory
Pearcy Bros.	Salem, Marion	Sipe	9-12	200	500	0	Not quaran- (Also had 100 R. sanguineum)
Oscar Lowe	Silverton, Marion	Sipe	9-13	200	200	0	Not in quarantined territory. All Ribes old, probably not for sale
Fruitland Nursery	Salem, Marion	Sipe	9-10	400	60	0	Not in quarantined territory
Totals				25,675+	4,265+	Several	

Some factors have conspired to decrease Ribes trade. Probably of first importance is the Blister Rust Quarantine which has discouraged nurserymen and growers alike in growing Ribes. Other discouragements are the gooseberry worm, mildew, anthracnose, and the fact that the canneries refuse to handle any quantities of the fruit.

INSPECTION FOR BLISTER RUST

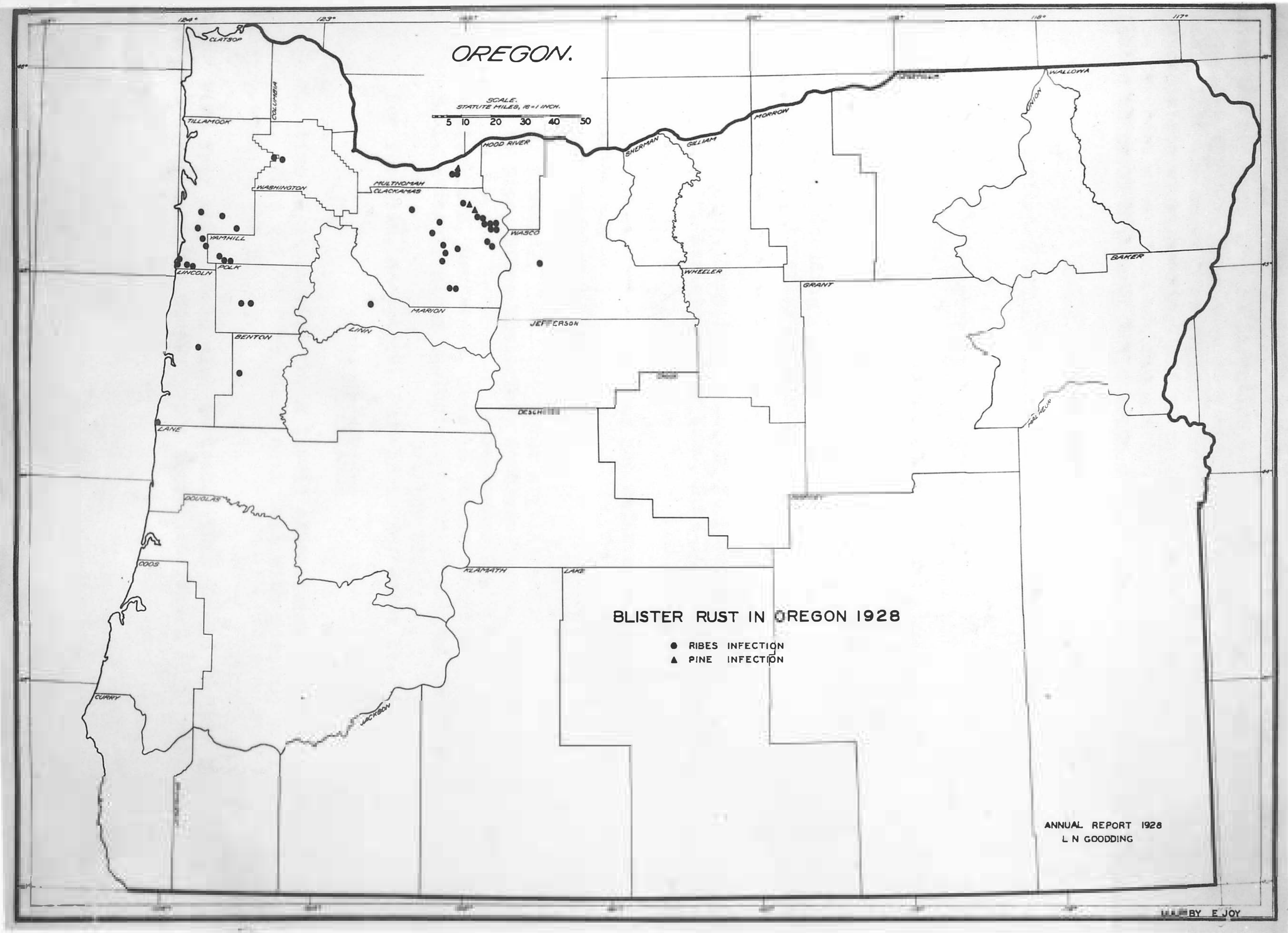
On April 25 the pines on Herman Creek in Hood River County, associated with infected Ribes in the fall of 1927, were examined but no infection was found. On May 24 a trip was taken to the head of the Wilson River. Nothing at that time indicated conditions as they were found in the fall. The region, however, is quite inaccessible, and adequate scouting to determine pine and R. bracteosum associations has not been done. On May 30 the first pine infection in the state was located above Palmer. Later scouting in this region failed to reveal more than the two trees originally located. The limited area of this infection led to the belief that something might be accomplished by taking out the pines in association with the Ribes. This was done during the latter part of June. Later inspections have revealed how utterly hopeless such an undertaking becomes in such regions as eastern Multnomah and Hood River counties.

Some scouting for infection on pines was done in the neighborhood of the Wind River Nursery in Washington during the time eradication was taking place at the Nursery, but no infection was found.

During the latter part of August Mr. Evinger scouted for the rust in the northeastern part of the state. Although he located considerable quantity of R. petiolare, he found no infection. Similar results were obtained during the scouting east of Mt. Hood in September.

On August 30 the eradication crew was taken from Still Creek to Palmer to inspect the Ribes for blister rust, primarily for the training the men would receive. As a result blister rust was found by one of the men August 31 on the Still Creek planting and later in another place in the same planting. A glance at the tabulated results of blister rust scouting and at the map will show the location of infections found later in the season. Considerable scouting was done down the coast as far south as Marshfield and in the Coast range for a similar distance. All the accessible streams in the Cascades down to and including the McKenzie were scouted, and the streams east of the mountains from Bend north.

A few results of the scouting should be emphasized. First, the prevalence of pine infection in Clackamas County with pine and R. bracteosum association excellent for many miles above Rhododendron insures a heavy intensification in the next few years. Second, the prevalence of infection on Ribes in Tillamook County and on Ilar Creek in Washington County in-


OREGON.
SCALE.
STATUTE MILES, 16=1 INCH.
5 10 20 30 40 50
124°
123°
118°
117°
CLATSOP
COLUMBIA
TILLAMOOK
WASHINGTON
MULTNOMAH
CLACKAMAS
HOOD RIVER
YAMHILL
POLK
LINCOLN
BENTON
MARION
LINN
WASCO
JEFFERSON
SHERMAN
GILLIAM
MORROW
WHEELER
GRANT
UNION
WALLOWA
BAKER
LANE
DOUGLAS
COOS
CURRY
JACKSON
KLAMATH
LAKE
BLISTER RUST IN OREGON 1928
● RIBES INFECTION
▲ PINE INFECTION
ANNUAL REPORT 1928
L N GOODDING
BY E JOY

dicates the presence of pine infection in the Wilson River County, which fruited last spring. This assures a heavy wave of the rust to the south, probably into the sugar pine region, the first favorable rust year. Third, the association of sugar pines and R. petiolare on the Metolius River east of the Cascades at a point not far distant from known infection this year indicates an early attack of the disease on this species. (See Table No. 14).

BLACK CURRANT ERADICATION

No cultivated black currants were located or eradicated during 1928.

OFFICIAL CORRESPONDENCE

Letters received - 375 Letters written - 325.

PERSONNEL

Leslie N. Goodding - State Leader.
Mrs. M. S. Brierley - Stenographer.

E. M. Hornibrook - Camp Boss, June 16 to June 30
Kenneth Gray, Camp Boss, June 16 to September 30
Eldon Lyle, Assistant Camp Boss, June 16 to September 22

G. R. Goodall)
Herbert Judson) Crewman not under appointment.
James Denton)
Arthur Hinckley)

J. B. Simmonds, Cook, not under appointment.
F. P. Sipe, Ribes Ecologist, southern Oregon, June 16 to September 30.
Walter Lund, assistant, June 16 to September 20
E. L. Evinger, Ribes Ecologist, northern Oregon, June 16 to October 31.
Roy Woodside, Assistant, June 16 to September 17.

RECOMMENDATIONS

The time is about ripe for a lively educational campaign in the Oregon schools. This should take place next fall with possibly a little preliminary work in the spring.

Some Fair work should also be done. This should include exhibits at Salem and several of the County Fairs in regions where white pine is prevalent.

TABLE NO. 14

RECORD OF BLISTER RUST INFECTIONS FOUND 1928, OREGON.

County	Region	T.	R.	Section	[illegible]	Number [illegible]	[illegible]	Details of Infection [illegible]	* [illegible]	[illegible]	[illegible]	[illegible]	Remarks
Benton	3 mi. S. Blodgett, Mulkey [illegible]	[illegible]	7W	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Clackamas	[illegible] Creek	[illegible]	[illegible]	23	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	Eagle Creek	3S	5E	[illegible]	R. bracteosum	500-1000	1	5 per cent	[illegible]	[illegible]	[illegible]	[illegible]	
	Eagle Creek 1 Mi. S. W. Eagle Creek Post Office	[illegible]	3E	[illegible]	R. [illegible]	[illegible]	1	5 per cent	[illegible]	[illegible]	[illegible]	[illegible]	
	Between Rhododendron & Sandy Lumber Company Holdings	2S 2S 3S	6E 7E 7E	22,23,24,[illegible]. 29,30,31,32,32. 2,3,4.	P. monticola	400	[illegible]	[illegible]			Goodding, Lund Gray & Evinger	[illegible]	
	Between Rhododendron & Sandy Lumber Company Holdings	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] per cent; 1 per cent; 1 per cent	Excellent Excellent [illegible]	Open to shade Shade, dry Open, dry	[illegible]	[illegible]	
	Salmon River, Tawnes Hotel to Salmon	[illegible]	[illegible]	[illegible]	[illegible]	500	[illegible]	[illegible] per cent	[illegible] poor	Open to partial shade. Adjacent to stream.	[illegible] & Gray	[illegible]- 9-28	
	Lower end of Still Creek planting	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	5 per cent	Good	Open adjacent to stream	Hinckley	[illegible]- 1-28	
	1/4 Mi. S. E. Rhododendron	3S	7E	11	P. monticola	25	1	1 tree 1 canker Probably 1925			Goodding	9- 7-28	
	2 Mi. below Still Creek planting cabin	3S	8E	34	[illegible]	100	1	2 per [illegible]	Good	Open adjacent to stream	Gray & Lund	9- 7-28	
	3 Mi. below Still Creek planting cabin	3S	8E	33	R. bra[illegible]	100	1	2 per cent	Good	Open adjacent to stream	Gray & Lund	[illegible]	
	4 Mi. below Still Creek planting cabin	3S	8E	29	R. bracteosum	100	1	2 per cent	Good	Open adjacent to [illegible]	Gray & Lund	9- 7-28	
	5 Mi. below Still Creek [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Lincoln	4 Mi. West of Eddyville	10S	9W	29	G. divaricata	25	1	1 per cent	Very poor	Open, dry	[illegible]	[illegible]	[illegible]
	[illegible] Mi. East [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible] per [illegible]	Very [illegible]	Overhanging stream	[illegible]	[illegible]	
Marion	Silver Creek Falls	8S	1E	[illegible]	R. bracteosum	50	1	[illegible]	Very poor	[illegible]	Goodding & Evinger	10-20-28	In spray of Falls
Multnomah	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	
	Near Palmer	1N	6E	19	R. bracteosum	[illegible]	[illegible]	[illegible] per cent	[illegible]	[illegible]	[illegible]	[illegible]	
	Near Palmer	1N	6E	19, 20.	[illegible]	[illegible]	[illegible]	[illegible] per cent	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Polk	Black Rock	[illegible]	7W	14	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	1 Mi. West of [illegible]	[illegible]	6W	17	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Tillamook	2 Mi. North Otis	[illegible]	[illegible]	[illegible]	R. bracteosum	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	1 Mi. South Neskowin	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	3 Mi. South Neskowin	6S	10W	9	R. bracteosum	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	5 Mi. S. of Neskowin, Lincoln Tillamook line	6S	10W	14	R. bracteosum	500-1000	[illegible]	[illegible]	Very poor	Open adjacent to stream	Lyle & Hinckley	9-17-28	
	[illegible] Mi. North of Hebo	4S	10W	[illegible]	G. divaricata	500-1000	1	1 per cent	[illegible]	[illegible] adjacent to stream	Lyle & Hinckley	9-15-28	Most of inspection on R. bracteosum
	[illegible]eplock	3S	9W	7	R. bracteosum	[illegible]	1	[illegible] per [illegible]	[illegible]	[illegible] adjacent to stream	Lyle & Hinckley	9-16-28	
	[illegible]	2S	8W	17	[illegible]	[illegible]	1	[illegible] per [illegible]	Very [illegible]	Open adjacent to stream	Lyle & Hinckley	9-18-28	
	8 Mi. E. of Blaine on Nestucca River	[illegible]	7W	6	R. bracteosum	500-1000	1	5 per cent	[illegible]	Open adjacent to stream	Lyle & Hinckley	9-16-28	
	3 Mi. S. of Hebo on Three Rivers	4S	9W	29	R. bracteosum	500-1000	1	5 per cent	Very poor	Open adjacent to [illegible]	Lyle & Hinckley	9-19-28	
	5 Mi. S. of Hebo on Alder Creek	[illegible]S	9W	9	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	9-19-28	
	[illegible] Mi. E. of Dolph	[illegible]	8W	29	R. bracteosum	500-1000	1	5 per cent	Very poor	[illegible]	[illegible]	[illegible]	
	6 Mi. E. of Dolph	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	9-20-28	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Wasco	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Washington	1½ Mi. W. Gales Creek on [illegible] Creek									[illegible]	[illegible]		Scattered along 1 [illegible]
Yamhill	[illegible] Mi. W. of Gran[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

* By "Pine Association" is meant the distance from infected Ribes to pines according to the following key:

Excellent	- Pines 100 feet or less from infected Ribes.
Very good	- Pines 101 to 250 feet from infected Ribes.
Good	- Pines 251 to 500 feet from infected Ribes.
Fair	- Pines 501 to 1000 feet from infected Ribes.
Poor	- Pines 1001 to 1500 feet from infected Ribes.
Very poor	- Pines over 1500 feet from infected Ribes.

If possible, a sufficient crew should be put into the Still Creek area to complete the job, at least the first covering of the ground.

The Wind River Nursery will need to be as thoroughly worked as it was this year.

It is nearly time for some inoculation work on species of Ribes not up to this time associated with blister rust. Perhaps this will fall under Lachmund's office.

Scouting for the disease should be made more extensive in the Blue Mountains, and east of the Cascades the coming year. Conditions also should be more carefully studied in the Wils8n River region and in the Black Rock Region. The coast range and coast will need scouting to the Roseburg and Marshfield areas and possibly further southern.

ACKNOWLEDGMENTS

Acknowledgments are due the Forest Service and the Northwestern Experiment Station for their helpful cooperation. At the Wind River Nursery the bunk house and mess house were turned over to our crew for use. The Forest Service officials aided us in many ways.

BLISTER RUST CONTROL WORK IN CALIFORNIA
1928

Blister rust control work in California was carried on, as in the past, as a cooperative project between the California Department of Agriculture, California State Board of Forestry, College of Agriculture of the University of California and the Bureau of Plant Industry. The basic memorandum of understanding upon which this work was organized was made effective July 1, 1927 and can be found in the report for that calendar year. The following is the amendment to this memorandum to cover the work as organized for the Federal fiscal year 1929, beginning July 1, 1928:

"AMENDMENT TO
MEMORANDUM OF UNDERSTANDING
Effective July 1, 1927

Between

THE UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY
and the
CALIFORNIA DEPARTMENT OF AGRICULTURE - - - THE CALIFORNIA STATE BOARD OF FORESTRY - - - and the COLLEGE OF AGRICULTURE, UNIVERSITY OF CALIFORNIA.

Cooperative Work in Controlling White Pine Blister Rust in CALIFORNIA.

* * * * * *

"Paragraph E-6 of the Memorandum of Understanding described above contains the following:

> "'For the Fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $19,000 to the support of this cooperative work, the California Department of Agriculture approximately $9,000, the California State Board of Forestry approximately $5,000, and the College of Agriculture, University of California shall contribute in value approximately $3,000; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence.'

"In accordance with the foregoing provision, it is mutually agreed that for the fiscal year ending June 30, 1929 there will be expended by the California Department of Agriculture approximately $9,000.00, by the California State Board of Forestry approximately $5,000.00, by the College of Agriculture, University of California approximately

$5,000.00, and by the United States Department of Agriculture, Bureau of Plant Industry, through its Office of Blister Rust Control, approximately $33,800.00 in connection with cooperative blister rust control work in California.

Date:		Signature:
6/19/28	(s)	G. H. Hecke, Director, California Department of Agriculture.
6/25/28	(s)	M. B. Pratt, State Forester, California State Board of Forestry.
7/3/28	(s)	Ed. Merrill Dean, College of Agriculture, University of California.
Aug. 1 1928	(s)	K. F. Kellerman, Chief, Bureau of Plant Industry."

BLISTER RUST ACTIVITIES IN CALIFORNIA - 1928

By
G. A. Root
Assistant Pathologist

Reports on the work under way in California have been prepared by the several project leaders concerned. The reports on ecological studies of Ribes by Mr. F. A. Patty, control reconnaissance by Mr. T. H. Harris, experimental Ribes eradication and pre-eradication on the Plumas National Forest by Mr. W. V. Benedict, follow this report. An account of chemical investigations of possible Ribicides, by Mr. H. R. Offord, will be found in his special report.

I. Black Currant Eradication

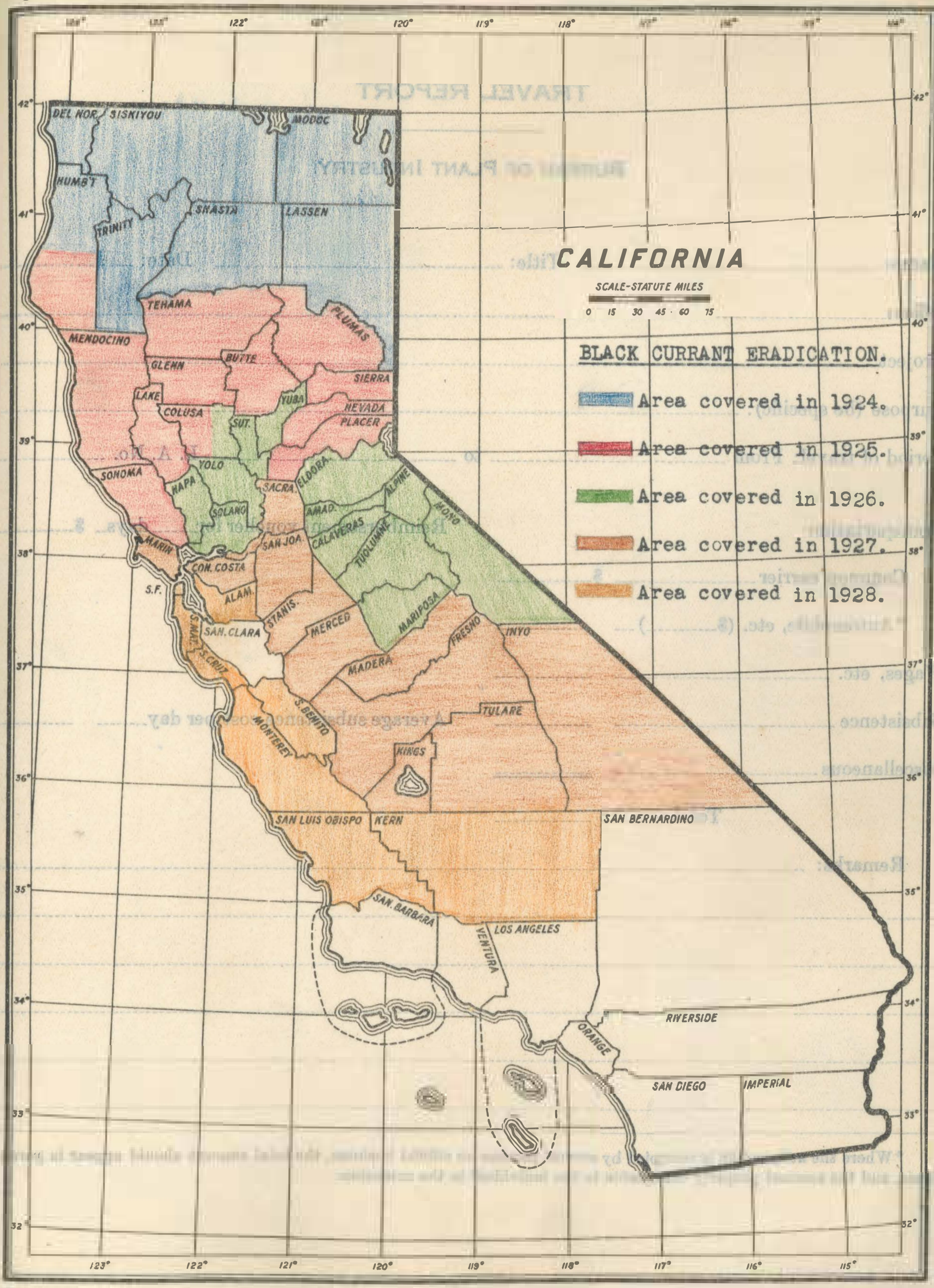
The season just closed marks the fifth in which this project has been under way. The full quota of six men started work at the usual time, about June 15th, and continued for a period of three months. Three automobiles were used for transportation. The personnel consisted of experienced men, a real asset because of considerable foot work and the presence of numerous plantings.

The following table shows the counties covered with plantings and bushes found therein:

County	No. Plantings	No. Bushes
Alameda	103	630
Monterey	6	22
San Luis Obispo	3	5
Santa Cruz	37	847
San Francisco	7	98
San Benito	0	0
San Mateo	39	196
Kern	0	0
Santa Clara (very small section)	2	3
*Contra Costa	1	5
Total	198	1806

*"Hold-over" from 1927.

The above total added to the number found in previous years (655 plantings with 3,921 bushes) makes a grand total of 853 plantings comprising 5,727 bushes found thus far in California. Up to the present time 49 counties have been completed. (See map.)


CALIFORNIA
SCALE-STATUTE MILES
0 15 30 45 60 75
BLACK CURRANT ERADICATION.
Area covered in 1924.
Area covered in 1925.
Area covered in 1926.
Area covered in 1927.
Area covered in 1928.
DEL NOR.
SISKIYOU
MODOC
HUMB'T
TRINITY
SHASTA
LASSEN
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
LAKE
COLUSA
YUBA
NEVADA
PLACER
SUT.
YOLO
SONOMA
NAPA
SACRA.
ELDORA.
ALPINE
SOLANO
AMAD.
MONO
MARIN
SAN JOA.
CALAVERAS
TUOLUMNE
CON. COSTA
S.F.
ALAM.
STANIS.
S. MAT.
SAN. CLARA
MERCED
MARIPOSA
S. CRUZ
FRESNO
INYO
MADERA
S. BENITO
TULARE
MONTEREY
KINGS
SAN LUIS OBISPO
KERN
SAN BERNARDINO
SAN. BARBARA
VENTURA
LOS ANGELES
RIVERSIDE
ORANGE
SAN DIEGO
IMPERIAL
42°
41°
40°
39°
38°
37°
36°
35°
34°
33°
32°
123°
122°
121°
120°
119°
118°
117°
116°
115°

WF-BRC-#57-5/3/35

#38 Scouting Form
#57

Scouting Form

			Ribes											White Pine			
			R. petiolare			R. inerme										
Sec.	Type Width Ch.	Insp. No.	Abund	Exam	Inf.	Abund	Exam	Inf.	Abund	Exam	Inf.	Erad. Type	Occur	Age Class	Exam	Inf

Owing to the heavily populated areas, yet to be completed, probably not more than four counties will be covered in 1929, which include Santa Clara, Santa Barbara, Ventura and Los Angeles. It is hoped that the survey of some of this territory can be expedited by "blocking-off" certain areas which, after a casual inspection, are found to be free of plantings. Certain factors manifest themselves as not being conducive to the growing of these bushes, such as small yards, often found in connection with apartment houses, very sandy soil, excessive heat accompanied by a scarcity of water and lastly new subdivisions consisting of recently built houses. With a good county agricultural organization such as in Los Angeles County, it is expected that the work will be greatly facilitated.

II. Nursery Inspection

This type of work during 1928 consisted of the inspection of nurseries in those counties where the black currant work was carried on. The inspections were made by the black currant scouts. No black currants were found in any of the nurseries. The list of nurseries is constantly changing and the new ones are being "followed up" in the course of the work. Considerable information is received from time to time from the Superintendent of Nursery Service of the State Department of Agriculture. At this point should be mentioned the fine cooperation received from the various state and private interests in the performance of this work.

III. Educational Work

No radical changes have been made in this important phase of the project. An intensive campaign is carried on during the black currant work, while throughout the year a continuous but less vigorous one is maintained. Some of the agencies used are as follows:

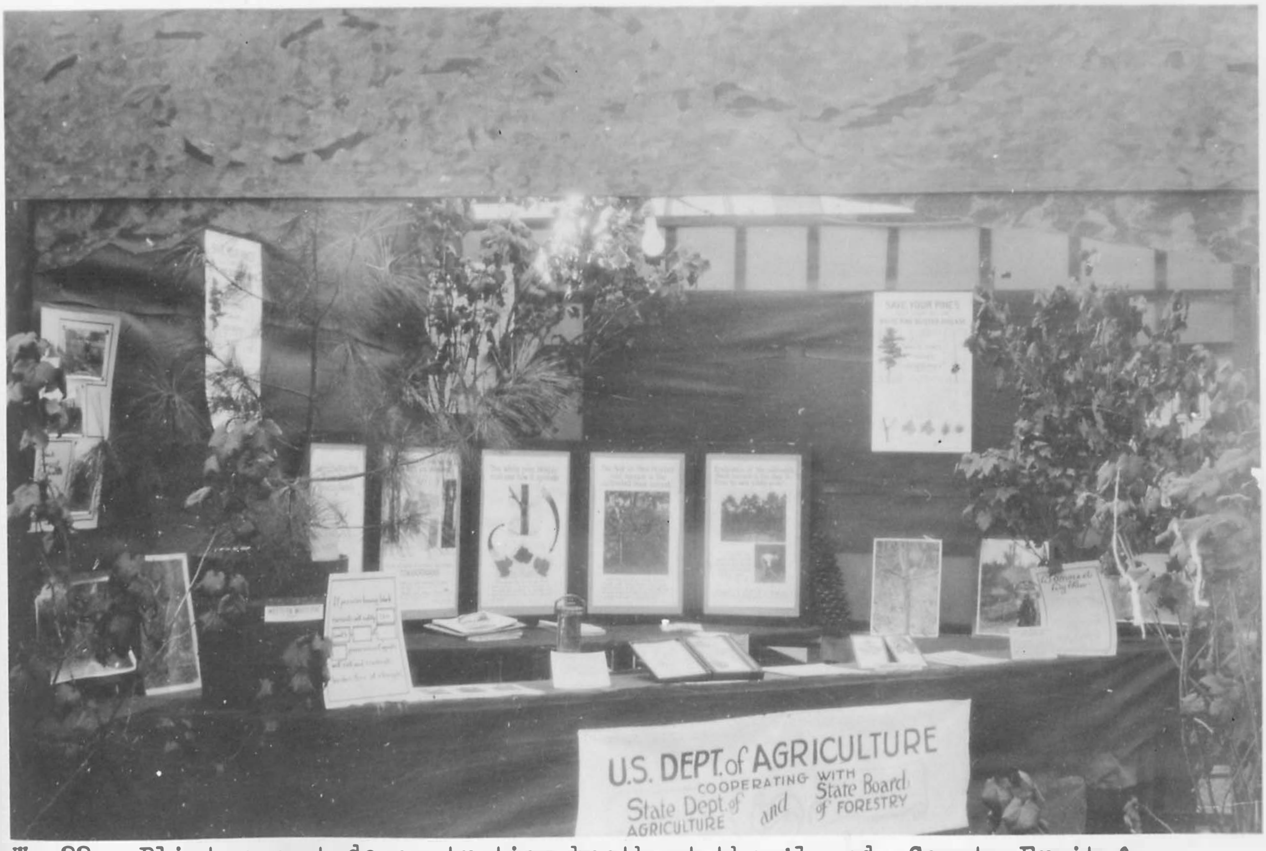
A. Panel Exhibits

Three of these have been used by the Sacramento office during the past four years. They are placed in store windows where available, often supplemented by additional photographs. In some sections where currants and gooseberries are raised commercially, they have proved to be quite successful. Although not appraoching other agencies as to benefits derived, they fill a needed gap in the educational program.

B. Blister Rust Film

This was used more extensively this year than last. It was shown in seven towns before an aggregate of 8,000 people. It is still difficult to get all theaters to agree to showing the film. Fortunately

W. 24. A planting of 47 black currant bushes, R. nigrum, on the Diamond Ranch near Menlo Park, San Mateo County, California.



W. 22. Blister rust demonstration booth at the Alameda County Fruit & Produce Show. Hayward, California, August 7-11, 1928.

there was no opposition to its presentation in one of the large commercial growing sections of black currants on the coast.

C. Exhibits

Curtailment of space again at the State Fair in Sacramento prevented the use of a large exhibit such as was used in 1924, 1925 and 1926. Specimens, however, were incorporated with the exhibit of the quarantine division of the State Department of Agriculture and formed a small but neat display.

The best blister rust demonstration was set up by the black currant scouts at the Agricultural and Produce Show of the Hayward Farm Bureau at Hayward. Centered around the 5-panel exhibit were photographs and specimens of the black currant and 5-needle pines. (See photo.) This exhibit created considerable interest and was responsible for the location of several black currant plantings.

An exhibit was set up in the lobby of the municipal auditorium at Stockton in connection with the annual convention of the American Legion in that city. This was brought about at the suggestion of Mr. Law, a black currant scout and a member of the organization. Conservation of natural recourses is part of the program sponsored by the organization, so the subject of blister rust was not out of place.

D. Posters, Bulletins and Letters

Letters and posters were sent to the postmasters of the eight counties which were covered this season. It was requested that the posters be placed on the bulletin boards of the various post offices. This has been in keeping with the policy adopted since the inception of the work in 1924.

At the request of the Long Beach High School and the Botany Department of Mills College in Oakland, bulletins and specimens were sent for study.

E. Newspapers

The insertion of articles in newspapers proved to be one of the best methods for dissemination of blister rust information. Results obtained this year were particularly gratifying. Articles were inserted in 25 newspapers represented by nearly that number of towns.

An excellent article on blister rust appeared in a recent issue of a trade journal. The American Trust Review of the Pacific,

edited by the publicity bureau of the American Trust Company of San Francisco. A request for material from this office was a voluntary one. For such an article to appear in a publication of this kind is unusual, but it shows interest in conservation of forest resources on ths part of an industrial organization not closely associated with timber production.

F. Talks

Several of these were given the past year. The writer gave one, supplemented by lantern slides, at the local control camp at Dorrington before the eradication personnel and others camping in the vicinity.

At the Polytechnic High School at Long Beach, the instructor in biology, H. B. Gray, gave a lecture supplemented by lantern slides. C. F. Lackey, a former employee of the Blister Rust Office, now with the Citrus Experiment Station at Riverside, gave two talks supplemented by slides, before commercial clubs of that city.

In keeping with Forest Protection Week of last April, a talk was broadcasted from Station KGO located in Oakland. One night a week is reserved for the State Department of Agriculture or its cooperative agencies.

IV. Scouting for the Disease

No well defined scouting program was conducted during 1928. The black currant scouts made a careful inspection of all bushes they removed and also of planted 5-needle pines where found. The coastal area, the scene of this year's cultivated black currant eradication work, would furnish ideal conditions for the propagation of the rust. It is believed it would have been found if present.

The writer made careful inspections of many wild Ribes both in the Stanislaus and Plumas National Forests. A sharp lookout was kept for anything that appeared to be the rust on sugar pine in many parts of the two forests.

V. Recommendations

With the spread of the rust in a southerly direction in Oregon in 1928, it will be well to put on an organized scouting campaign in 1929 in the northern part of California from the coast east through the Siskiyou Mountains. A recheck of Alpine County should be made to ascertain if black currants have sprouted where previously removed or if new plantings have been set out, these bushes possibly coming from plantings in Nevada close to the Alpine County line.

The status of the black currant eradication would seem to indicate that no radical changes are necessary. It is a matter of continuing south with the work until the state is completed.

RIBES ECOLOGY - CALIFORNIA 1928

By
Frank A. Patty
Junior Pathologist

I. INTRODUCTION

The summer of 1928 marked the beginning of the ecological studies in the sugar pine regions of California. The Stanislaus National Forest was selected as the most desirable locality in which to begin these studies for considerable data have been obtained there during the last few years by the eradication and reconnaissance forces. This forest offered a large area of consecutively cut-over land as well as a fairly large stand of virgin pine. More recently fairly large areas have been cut over under the supervision of the U. S. Forest Service, while adjacent areas have been completely denuded by private operations. Such a variety of conditions presented an unexcelled opportunity for some interesting studies concerning Ribes regeneration.

The entire western exposure of the Sierra Nevada Mountains presents a very interesting picture of the life zones or belts. On this exposure are found most of the life zones which are outlined by Dr. C. Hart Merriam. The main body of sugar pine is found within the Transitional Life Zone, and bordering this zone on the lower side is the Upper Sonoran Life Zone; on the upper border is the Canadian Life Zone. The Upper Sonoran Life Zone is also termed the foot hill belt, the Transitional Life Zone the yellow pine belt, and the Canadian Life Zone the upper coniferous belt. A brief description will be given for these life zones or belts. The conditions given for these zones are as they apply to the Stanislaus National Forest, for the writer is not familiar with the conditions prevailing on the other national forests on the western slope of the Sierra Nevada Mountains.

A. Upper Sonoran Life Zone:

The Upper Sonoran Life Zone, or the foot hill belt,as it is more descriptively called, because it lies in the foot hills of the Sierra Nevada Mountains, is made up largely of Chapparal, a name given to dense brush thickets. A few scattering pines and oaks constitute the remainder of the tree population of this zone. Grasses and herbaceous plants grow among the trees and shrubs. These succulent plants must appear early in the spring when there is sufficient moisture in the soil to sustain growth. The brush consists of leathery thick leaves specimens, often very spiny, sticky and woolly, which are characteristic of plants growing in hot dry regions. The upper limits of the belt or zone reach an altitude of about 4,300 feet on the southern and western exposures, while the lower limits descend to an altitude of about 2,000 feet on the cooler northern and eastern exposures. The more normal range of this belt is between 2,500 and 3,000 feet. In some locations the Transitional Life Zone completely surrounds a small area of the Upper Sonoran Life Zone and vice versa.

W. 46. Two types of logging operations within the boundaries of the Stanislaus National Forest, California. Clear cutting in the foreground and selective cutting, under standard Forest Service marking rules, in background.

W. 39. Leland Meadow, Stanislaus National Forest, California. Altitude 6800 feet. R.viscosissimum, R.cereum, R.nevadense and G.roezli grow in profusion along the edges of such meadows.

The soil of this belt is very poor and thin. The frequent brush fires burn off the small amount of humus which accumulates in the soil. The lack of humus allows the soil to dry out very early in the spring, so all the plants which continue growing after the soil dries out must necessarily be deep rooted. A period of drought lasts from about four to six months.

It is in this belt where most of the large forest fires of California occur. The extreme long period of dryness makes the vegetation highly inflammable. The roughness and the inaccessability of some of the country makes fire control a difficult problem.

A few of the common plants of the Upper Sonoran Life Zone are the Digger Pine (Pinus sabiniana), the scrub oak (Quercus dumosa), poison oak (Rhus diversiloba) and the California Buckeye (Aesculus californica).

B. Transitional Life Zone:

The Transitional Life Zone, which is the region of commercial timber and hence the scene of all important logging operations, meets the foot hill belt at an average elevation of about 3,000 feet while its upper limits extend to about 6,500 feet. However, on the warm, moist slopes it may reach an altitude of 7,500 feet. There is a fairly long period of drought in this belt extending over a period of from three to five months. The days are quite hot and the nights are fairly cool. The latter condition probably allows plants to catch up with the high transpiration which takes place during the day. The soil is quite deep, but by the middle of the summer it is almost powder dry to the depth of several feet.

At the lower edge of this belt the yellow pine (P. ponderosa) and the incense cedar (Librocedrus decurrens) meet the Digger Pine of the foot hill belt. Here quite often the line of demarcation between the two belts is so sharply defined that it looks as if a huge knife had cut the dividing line. Such a knife might be represented by such factors as soil, moisture, temperature and humidity. The yellow pine and the incense cedar are met by the white fir (Abies concolor) and the sugar pine (P. lambertiana) as the elevation increases. In general the sugar pine and fir are found on the eastern and northern exposures and the yellow pine and sugar pine on the southern and western exposures. Near the upper limits of this zone the Jeffrey pine (P. jeffreyi) and the red fir (A. magnifica) replace the sugar pine, white fir and yellow pine. The red fir and the Jeffrey pine are really infusions from the adjoining zone. A number of groves of the big tree (Sequoia gigantea) are found on this forest. Some of the more common decidious trees are the flowering dogwood (Cornus nutallii), the white alder (Alnus rhombifolia) and the black oak (Quercus kelloggii).

Some of the more common shrubs are the snow brush (Ceanothus cordulatus), the deer brush (C. integerrimus), the wild rose (Rosa californica), manzanita (Arctostaphylos patula), the bush chinquapin (Castinopsis sempervirens), the snow berry (Symphoricarpos mollis) and the bear clover (Chamaebatia foliosa). The last named plant often covers entire exposures

in a dense mat. It is quite resistant to killing by fires, usually sprouting vigorously from roots and crowns after light burns.

It is in this region that Ribes are of such a great importance in blister rust control, because of their intimate association with sugar pine. The two important species are Grossularia roezli and Ribes nevadense. The former grows on all timbered slopes and is one of the first plants to appear after an area has been cut over. R. nevadense has a definite moisture requirement and is found only along streams and on rather moist slopes. Both of these plants are deep rooted and require considerable labor in hand eradication. G. roezli is often found on moist slopes in association with R. nevadense. R. cereum and R. viscosissimum are found scattered in the upper part of the sugar pine region, but they do not constitute a serious problem on this forest in the control of white pine blister rust. They grow in greater numbers and abundance at a higher elevation in this latitude.

C. Canadian Life Zone:

The Canadian Life Zone represents a part of the upper coniferous belt which lies altitudinally above the Transitional Life Zone. The summers are somewhat cooler in the upper coniferous belt than in the lower one, because of the higher elevation in the former. The winters are colder and the summers are shorter bringing about different species of trees, shrubs and plants. Some of the trees of this region are the silver or Idaho white pine (P. monticola), lodgepole pine (P. contorta), and the Red Fir (A. magnifica). None of these species at the present time are considered as desirable commercial species by the lumbermen. The Idaho white pine assumes a rather dwarfed and scragged appearance.

II. Purpose

The purposes in general of a Ribes ecology or Ribes autecology program are as follows:

1. To find out about the regeneration of Ribes after logging operations.

2. To discover what factors influence Ribes growth.

3. To determine if viable Ribes seed is stored in the soil.

4. To ascertain if any methods of silivicultural practice can be used in Ribes suppression.

5. To discover any facts which will be of aid in the suppression of Ribes, and consequently aid in the control of white pine blister rust.

III. Location and Description of Areas

All of the work for the ecology project was done on the

Stanislaus National Forest in California. These studies were conducted on four major areas on this forest, that representative data of all existing conditions might be obtained.

A. The Strawberry Area:

The Strawberry area has been the scene of experimental hand eradication studies for the seasons of 1926 and 1927. The chemical eradication forces have also been conducting their experimental eradication work in this same location. A fairly large section of land was worked over before logging and a similar area after logging, thus making an ideal location for studies on the best time to eradicate - that is, before or after logging. A ten-acre fenced plot was available to study the effect of grazing on logged-over areas. This area also offered a large tract of consecutively cut-over land which was cut under the supervision of the United States Forest Service. All of the above factors made this area a valuable place to obtain information on the regeneration of Ribes under various disturbances of soil conditions.

B. The Mather Area:

All the timber on the Mather area has been cut under the supervision of the United States Forest Service. Most of this land was cut over in 1924, 1925 and 1926. The particular areas on which the logging was done do not represent as good a sugar pine stand as the Strawberry area.

C. The Hazel Green Area:

All the cutting which has been done on the Hazel Green area was carried on by private companies on their own land. Hence, the residual stand of timber which was left by these companies amounted to practically nothing. A small area of land here was cut under the supervision of the United States Forest Service but it was not studied. All indications from the stumps pointed to the fact that a good part of this locality had been an excellent stand of sugar pine. Some of the finest sugar pine of this forest is still found near Hazel Green and adjacent areas in the Yosemite National Park.

D. The Dorrington Area:

The region about Dorrington is still a virgin stand of timber, where poorly and well stocked sections of sugar pine may be found. This was the region where the hand eradication forces operated in the summer of 1928. A limited amount of work was done here in spots where bushes had been eradicated. These studies were made chiefly to note the growth of seedlings after a soil disturbance. The experiment is not designed to duplicate any studies of rechecking to be made at a later date by the eradication forces.

W. 40. G. roezli growing along an old log chute. Stanislaus National Forest, California.

W. 41. Area logged in 1924. Brush lopped and scattered. Note numerous bushes of G. roezli. Stanislaus National Forest, California.

IV. Studies Under Way

The following list of studies was begun by the ecology project on the Stanislaus National Forest. Some of the studies will only be mentioned here because they have not been carried on for a sufficient length of time to warrant any discussion.

A. The Strawberry Area:

1. Permanent milacre plots.

    a. Where brush has been piled and burned.

    b. Where brush has been lopped and scattered.

    c. Eradicated cut-over lands.

    (1) Eradicated before logging.

    (2) Eradicated after logging.

    d. One small burn of 1927 origin caused by logging operations.

    e. Plots where chemical eradication work has been done to study restocking of Ribes by seedlings.

2. Temporary milacre plots on cut-over lands dating from 1919 to 1928.

3. A set of thirty-six milacre plots of the fenced and screened type for germination studies on a south exposure. Seeds and fruits collected in 1927 and 1928 were planted on this area. The effect of mechanical disturbances of the soil, the role of birds, rodents and other animals and the presence of Ribes seeds stored in the soil are some of the other problems for which this set of plots has been made. This plot was originally covered by young white firs and cedars, *Ceanothus integerrimis* and *Arctostaphylos patula.*

B. The Mather Area:

1. Plots of a temporary nature on areas logged in 1923, 1924 and 1925 were made here.

C. The Hazel Green Area:

1. Temporary plots were established here on areas cut in 1924, 1925 and 1926.

D. The Dorrington Area:

1. Studies were made of crowns and roots left in the eradication of *G. roezli.*

2. A few plots were made for the study of root and light competition.

E. General Studies:

1. The collection of leaves for the leaf-area-live stem measurements.

2. The collection and classification of plants found on plots.

3. General observations on conditions pertaining to Ribes growth.

V. Methods and Results of Studies

A. Identification and Listing of Plants Found on Plots:

An attempt was made to collect and carefully identify all of the plants found on the plots. This list does not include all the plants of the region, but it does take in most of the more common ones. It was necessary to give each species a definite symbol so that these symbols might be used for convenience of placing the different plants on the mapping sheet. For simplicity the plants were divided into three groups - trees, shrubs and herbs. The first letter of the genus and the first letter of the species were capitalized in making symbols for the trees. For the shrubs symbols were made for each plant by capitalizing the first letter of the genus and subordinating the first letter of the species. Both beginning letters of the species and genus were used as subordinate letters for the symbols of the herbs. When two plants had the same initials a few letters were added to the species to prevent confusion. A list of such plants was developed and carefully checked in the fall of the year by David I. Goddard.

B. Ribes Regeneration after Logging:

1. Definition of experiment. This study was begun to note the number of Ribes that come back after an area has been cut over and to follow thru these bushes from year to year to determine when they start to be shaded out. To determine what species of brush or trees are instrumental in shading out these Ribes.

2. Methods and area selected. An area of ten acres at Cow Creek which was cut in 1923 and fenced in 1927 was selected as the best place to carry on this experiment. The fencing will prevent damage and destruction of the various plants by stock and tourists. All of the bushes on this ten-acre plot were staked and their age determined in 1928. Ceanothus, bear clover and other forms of brush have been appearing on the plot and making a rapid growth; consequently, within a few years shading and root competition should be showing their effects on the growth of the Ribes plants. The age at which the new bushes begin fruiting will be determined from this experiment.

3. Results so far obtained. Table No. 1 shows the age, species, and fruiting conditions of the Ribes bushes on the plot. This table indicates that few seedlings were produced in 1928 and that no seedlings which were produced in 1927 have survived. Only three of the new bushes are producing fruit and they were not bearing a heavy crop. There were 2.6 Ribes per acre on this area after logging in 1923, and in 1928 there were 8 Ribes per acre.

TABLE NO. 1

FREQUENCY DISTRIBUTION OF RIBES BY SPECIES ON COW CREEK EXPERIMENTAL PLOT.

Age Class	G. roezli		R. cereum		R.viscosissimum		Ribes Per Acre
	Fruiting	Not Fruiting	Fruiting	Not Fruiting	Fruiting	Not Fruiting	
Present before logging	15	11	0	0	0	0	2.6
Three years old	3	14	0	2	0	0	1.9
Two years old	0	29	0	0	0	1	3.0
Seedlings	0	5	0	0	0	0	.5
Totals	18	59	0	2	0	1	8.0

C. Temporary Milacre Plot Studies:

1. Purpose of the experiment. The purpose of this experiment was to determine how soon Ribes appear after a disturbance by logging, and how long they continue to appear.

2. Methods and areas selected. This experiment was conducted at Strawberry, Mather and Hazel Green on cut-over lands dating from 1919 to 1928.

The plots were laid out under two methods. A total of 795 milacres was by the following method: Strips were run on a compass line thru the cut-over areas and a milacre established every six chains. The strips were run forty chains apart usually along the section line and thru the center of the section.

The other 325 milacres were by the following method: Strips were run on a compass line thru the cut-over areas and a square plot of 25 milacres established every six chains.

TABLE NO. 2

RIBES REGENERATION AFTER
LOGGING STANISLAUS NATIONAL FOREST, CALIFORNIA.

Year of Logging	Number Milacres as Basis	Total Ribes Per Acre	Ribes Per Acre by Year of Germination									
			Same Season as Logged	1st Yr. After Logging	2d Yr. After Logging	3d Yr. After Logging	4th Yr. After Logging	5th Yr. After Logging	6th Yr. After Logging	7th Yr. After Logging	8th Yr. After Logging	9th Yr. After Logging
1919	112	991.1	-	116.1	71.4	89.3	107.1	160.7	267.9	125.0	35.7	17.9
1920-21	7	-	-	-	-	-	-	-	-	-	-	-
1922	71	70.4	-	14.1	14.1	-	14.1	-	28.1	-	-	-
1923	142	274.6	-	42.3	35.2	84.5	112.6	-	-	-	-	-
1924	500	974.0	4.0	20.0	104.0	408.0	438.0	-	-	-	-	-
1925	256	156.2	27.3	23.4	35.2	70.3	-	-	-	-	-	-
1926	21	95.2	-	47.6	47.6	-	-	-	-	-	-	-
1927	11	1,181.8	-	1,181.8	-	-	-	-	-	-	-	-
Total	1,120	622.3	8.0	44.6	67.9	217.9	221.4	22.5	40.0	17.5	5.0	2.5

Information regarding the ages of the cutting areas was obtained from the United States Forest Service and by counting the rings on the logging scars.

3. Results obtained. Table No. 2 shows the results of this study. This table indicates that Ribes seedlings appear in fairly large numbers after logging operations and continue to appear for a number of years. The wide variations in number of Ribes per acre indicate that the various areas are either unequally adapted to Ribes or unequally seeded with Ribes.

The results appear to indicate that very few Ribes seeds germinate during the period of logging, that this germination increases in amount, reaching the peak of germination in the third and fourth years after logging and then decreasing to a negligible amount of germination about ten years after the logging occurred. There were no Ribes on the plots which antedated the logging operations, but there were numerous bushes near the plots which were producing an abundance of fruits.

These old Ribes bushes which are present before logging bear scattered fruits while beneath the timber stand, but when the stand is opened, heavy crops of fruits usually result thereafter.

The mortality of Ribes seedlings is probably higher immediately after logging than several years later, when the protecting vegetation has considerably increased. Therefore, the Ribes which appear the first year after logging may be many times the number shown by the table, since so few plots of "first year" age are included.

<u>E. Controlled Plot Studies of Ribes:</u>

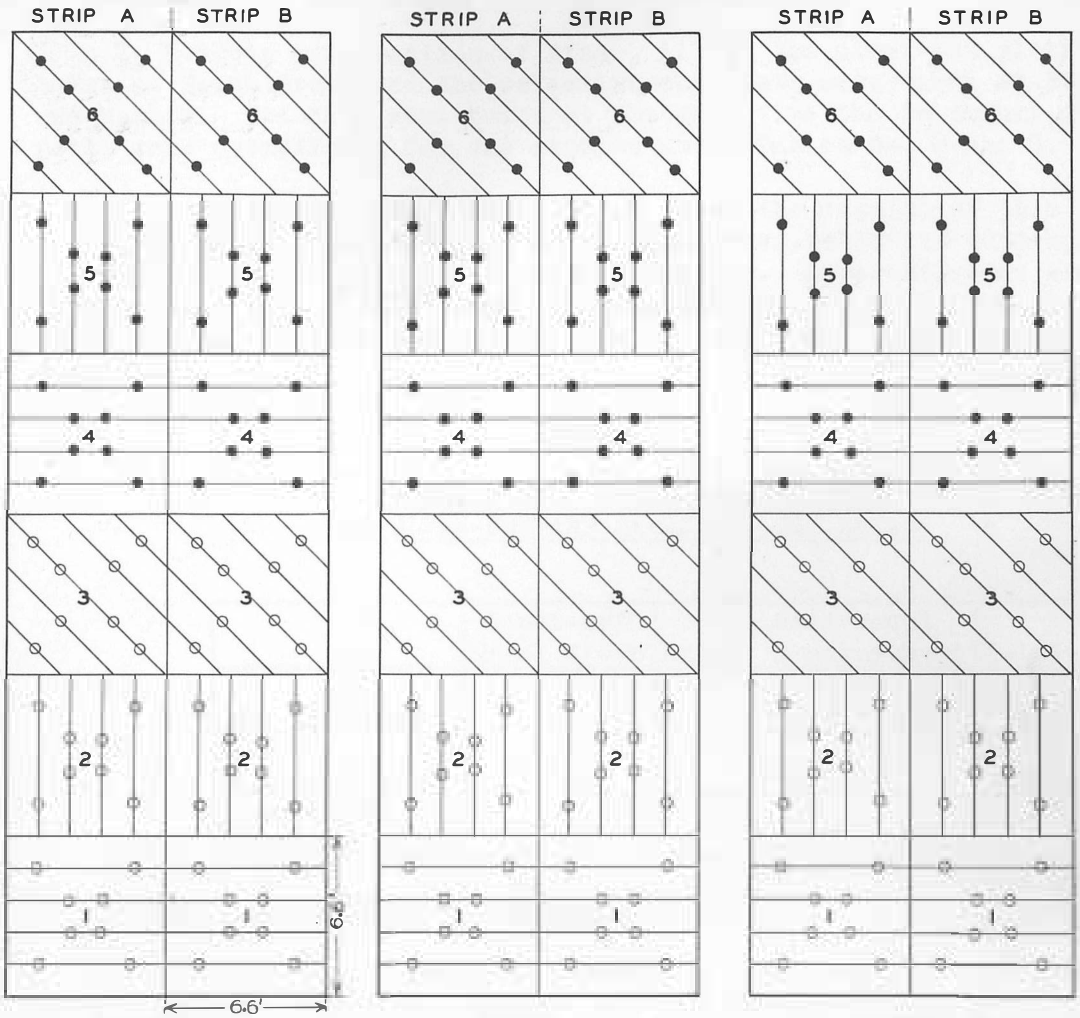
1. Purpose of Experiment. A study of controlled field conditions to note whether viable seeds of <u>G</u>. <u>roezli</u> or any other species are present in the duff or soil on the different slopes, and to determine if certain types of disturbances of the soil will cause these seeds to germinate. A study of the germination of planted seeds of <u>G</u>. <u>roezli</u> under field conditions to determine if any resting period is necessary before germination will take place, and to follow these plants thru, noting what percentages survive.

2. Methods Used and Area Selected. An individual set of experimental plots consisting of thirty-six milacre units laid out as follows: (The entire set of plots is fenced with barbed wire.) Block 1 is protected by the barbed wire fencing only. Block 2 is protected by a fence of window or fly screen which is set in the ground about four inches. Block 3 is fenced identically with Block 2 and covered with a muslin roof. This roof was removed late in the fall to prevent the heavy snow from breaking it down. Plots 1 have the shrubs and trees removed and are planted to seeds

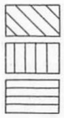
of *G. roezli* collected in 1928. No soil or duff disturbance was made. Plots 2 and 5 have the upper part of the duff removed as well as the trees and shrubs. Plots 2 are planted to *G. roezli* gathered in 1928 and Plots 5 to seed of the same species gathered in 1927. Plots 4 have the trees and shrubs removed but no soil or duff disturbance was made. The plots were planted to seeds of *G. roezli* gathered in 1927. Plots 3 and 6 have the shrubs and duff removed and the soil disturbed to a depth of three inches. Plots 3 are planted to seeds collected in 1928, and Plots 6 to seed collected in 1927. The planted Ribes on the set of plots are all staked so they can be distinguished from any seeds that were present in the soil.

3. Results obtained. An inspection was made of this group of plots in September but no new plants were found. Germination is not expected in the fall with *G. roezli* on the average dry slope, for the soil dries out so deeply that considerable moisture is necessary before a thorough wetting occurs. Before the ground is moist enough for germination the weather is probably too cold. Diagram No. 1 illustrates the manner in which these plots were laid out in the field.

DIAGRAM NO. 1



LEGEND



SOIL UNDISTURBED
DUFF REMOVED
DUFF REMOVED AND SOIL DISTURBED TO DEPTH OF 3"
○○○ FRUITS COLLECTED IN 1928 AND PLANTED IN 1928
●●● FRUITS COLLECTED IN 1927 AND PLANTED IN 1928

Annual Report 1928
F. A. Patty
(Copied by WVB)

F. Comparison of Ribes Regeneration on Clear-cut and Selective-cut Area:

1. Purpose of experiment. This study was started to note whether clear cutting or selective cutting would cause a greater Ribes population to come back. It is possible that Ribes require a certain amount of shade to germinate and grow especially on the warmer slopes.

2. Methods and location of area. All of the clear-cut plots were taken at Hazel Green and the selective-cut plots were taken at Strawberry and Mather. The data were taken at the same time the temporary milacre plots were established for the studies under Tables No. 2 and 3.

3. Results obtained. Table No. 3 shows the results of this study. A smaller Ribes population may be expected when selective cutting is practiced than when an area is completely denuded. Apparently the seed of G. roezli needs very little shade for germination. If this shade is required it is obtainable from the other forms of brush that come back after logging operations.

TABLE NO. 3

COMPARISON OF RIBES REGENERATION
ON CLEAR-CUT AND SELECTIVE-CUT AREAS

	Clear-cut Hazel Green	Selective-cut Mather & Strawberry	Totals
No. of Ribes	154	159	313
No. of Plots	213	600	813
Average No. Ribes Per Plot	.72	.27	

G. Cow Creek Slash Pine Burn Studies:

1. Definition. A study of slash pile burns was begun to note the effect of Ribes regeneration when the soil is lightly and heavily burned. On all Forest Service timber sale areas, the slash is piled and burned in the spring or fall of the year. These burned piles offer a very good place on which to study the effect of burning.

2. Methods and area selected. All of the slash pile burns studied were near Cow Creek and Strawberry. Plots were taken on the different slopes so average growing conditions could be had. The plots were mapped and the data recorded on the standard form W 36. The area in the center of the burn where the duff had been burned to mineral soil was considered as the "heavy burn". Just inside the margin of the burn and in places where the duff had not been completely destroyed was considered as the region of the "light burn". Outside of the burn where the duff had not

been affected by the fire the "margin of the burn" was established.

3. Results obtained so far. Table No. 4 shows the results obtained from studies made on seventy-one of these burns. It is interesting to note that more Ribes appear on the outside of the burn than inside of the burned area. The light and the heavy burning shows a very small difference in the number of Ribes plants appearing. No Ribes appear in 54 of the plots while 53 bushes appear on 17 plots. Twenty-three bushes are found growing where the duff has been burned and thirty bushes are present where logging alone has been the disturbance.

TABLE NO. 4

COW CREEK SLASH PILE BURN STUDIES.

Plot Number	Species	Age (Yr. of germ-ination)	Heavy Burn	Light Burn	(Outside) Margin of Burn	Date Logged	Date Burned
			Strip 1				
1-4	None						
5	G. roezli	1926			x	1924	Fall 1924
	"	1926			x	"	"
6-25	None					"	"
26	G. roezli	1926		x		"	"
27	None					"	"
			Strip 2				
2-4	None						
5	R. cereum	1928			x	1926	Spring 1927
6-7	None					"	"
8	R. cereum	1928			x	"	"
	"				x	"	"
	"				x	"	"
	"				x	"	"
9-11	None					"	"
12	G. roezli	1928		x		"	"
13	None					"	1927
14	R. cereum	1927			x	"	"
15	G. roezli	1928			x	"	"
16-17	None					"	"
18	R. cereum	1928			x	"	"
19-27	None					"	"
28	G. roezli	1923			x	1924	Fall 1924
	"	"			x	"	"
29	"	1927	x			"	"
	"	"	x			"	"
30	"	1926			x	"	"

TABLE NO. 4 (Continued)

Plot Number	Species	Age (Yr. of germ-ination)	Heavy Burn	Light Burn	(Outside) Margin of Burn	Date Logged	Date Burned
30	G. roezli	1926		x		1924	Fall 1924
	"	"		x		"	"
	"	"		x		"	"
	"	"	x			"	"
	"	"		x		"	"
	"	1925		x		"	"
	"	"		x		"	"
	"	"			x	"	"
	"	"			x	"	"
	"	"			x	"	"
	"	1927		x		"	"
31	None					"	"
32	G. roezli	1924			x	"	"
33	"	1926			x	"	"
	"	"			x	"	"
	"	"			x	"	"
	"	"		x		"	"
	"	"		x		"	"
	"	"		x		"	"
	"	1925		x		"	"
34	"	1927	x			"	"
	"	"	x			"	"
	"	"	x			"	"
	"	"	x			"	"
	"	"	x			"	"
	"	1926			x	"	"
	"	"			x	"	"
	"	"			x	"	"
	"	1927			x	"	"
	"	"			x	"	"
35-37	None						
38	G. roezli	1928			x	"	1924
39	"	1925			x	"	"
40-43	None					"	"
44	G. roezli	1928	x			"	"
	"	1926			x	"	"
	"	"			x	"	"
	"	1928	x			"	"
45	"	"			x	"	"
Total 71 plots	Bushes 53		Bushes 10	Bushes 13	Bushes 30		

TABLE NO. 5

INFLUENCE OF TIMBER SHADE ON THE NUMBER RIBES PER MILACRE

Timber Shade Per Cent	Total No. of Ribes	No. of Plots Bases	Average No. of Ribes per Milacre
0-9	548	548	1.00
10-19	97	135	.72
20-29	26	81	.32
30-39	18	54	.33
40-49	9	66	.14
50-59	14	34	.41
60-69	19	59	.32
70-79	0	15	.00
80-89	2	24	.08
90-100	5	34	.15
Totals	738	1050	.70

This table is presented to show the influence of shade on the number of Ribes per milacre. The per cent of timber shade was determined by ocular estimates. When a plant was effected by a few trees for part of the day its shade was considered as being from nothing to nine per cent. Ninety to one hundred per cent shade meant that a plant received little or no direct sunlight during the day. Of course these plots were in virgin timber where a soil disturbance had occurred.

TABLE NO. 6.

EFFECT OF EXPOSURE ON OCCURRENCE OF RIBES.

	Exposure					Totals
	N.	S.	E.	W.	None	
No. of Ribes	353.0	211.0	57.0	76.0	41.0	738.0
No. of Plots	268.0	321.0	87.0	259.0	115.0	1,050.0
Average Ribes Per Milacre	1.32	.66	.66	.29	.36	.70

The above table shows the effect of exposure on the frequency of Ribes. The table has a weak point in that it does not show a sufficient number of plots for the eastern exposure.

H. General Observations:

A heavy crop of seed was produced by R. nevadense, R. cereum

and _G. roezli_, in the summer of 1928. Sufficient observations were not made regarding the seed production of _R. viscosissimum._

Observations have shown that rodents and birds eat many of the Ribes fruits and seeds. The little chipmunk will cut every fruit from a _G. roezli_ bush and eat the contents, leaving only a hollow shell. Just what part animals and birds play in the dissemination or destruction of Ribes seed is a matter of conjecture. They may aid in the control of the Ribes population or they may be instrumental in increasing it by scattering the seed. Observations have shown that robins and quail are very fond of the fruits of _R. cereum_ and _R. nevadense._

This region is given over to the grazing of cattle during the summer. In an effort to obtain the maximum amount of feed from the forest, the cattle are divided into small herds of about ten to twenty animals. These small herds roam about from place to place in search of better forage. Near the end of the summer most of the herbaceous vegetation has dried up, and the cattle are forced to browse mostly on brush. This browsing and roaming about disturbs the soil and probably brings many Ribes seeds into position where they can germinate when conditions are right. On many of the cut-over areas and even in some of the virgin stands, conditions are favorable for germination. The cattle browse the more tender shoots of _R. nevadense_ but do not seem to hinder its growth or seed production. Observations thus far indicate that _G. roezli_ is rarely eaten by cattle on account of the spiny stems.

VI. General Conclusions

Any conclusions which are drawn at this time must be made with many reservations, for sufficient data have not been obtained to come to any definite conclusions. However, in light of the present data and careful observations which have been made during the summer of 1928 a few tentative conclusions will be made.

After an area has been cut the Ribes begin coming in the first year and continue to do so for a number of years. A small amount of seed is produced by the veteran bushes even in well shaded stands. This seed may account for the production of a few plants during the first few years. After the stand has been opened up the remaining veteran bushes take on a new life and produce fruits in abundance. Water, gravity, and animals are probably instrumental in bringing seeds into stands where there are few Ribes. It is not believed that the seeds are stored in the soil for any great length of time. It is quite probable that if a given number of seeds were present in the soil all of them would not germinate the first year due to physiological differences.

When all of the timber is cut from an area a greater Ribes population can be expected than if selective cutting has been practiced.

Cattle are probably very important in disturbing the soil and

moisture relations which influence the growth of Ribes.

G. roezli begins to fruit very lightly in its third year and then continues to fruit as long as sufficient light, moisture and food are available.

The lack of sufficient moisture during the growing season accounts for the absence of *G. roezli* on some warm exposures. *R. nevadense* has a very definite moisture requirement, hence, it is found only where sufficient moisture is available during the entire year.

R. cereum and *R. viscosissimum* are not found in sufficient number to constitute a serious problem in this latitude. Within the sugar pine belt, the optimum site for sugar pine appears to be the optimum site for *G. roezli*. This is due to the fact that both Ribes and sugar pine have a definite moisture requirement.

Birds and rodents are instrumental in the dissemination of Ribes seeds.

G. roezli is the species which is most common on the dry slopes. *R. nevadense* is confined to narrow strips along streams and rivers and to the moist slopes.

CONTROL RECONNAISSANCE
on the
PLUMAS NATIONAL FOREST, CALIFORNIA,

By
T. H. Harris, Agent.

I. Purpose

Control reconnaissance as done in California is a rapid and systematic survey of the Ribes and sugar pine conditions on a forested area relative to the spread and control of the white pine blister rust. Its purpose is the determination of the location and extent of major sugar pine areas, the Ribes conditions existing thereon, and the approximate costs of insuring such areas protection against the rust.

II. Location of Work

Reconnaissance during the field season of 1928 was confined to the Plumas National Forest at the northern end of the Sierra Nevada in northeastern California.

A. Reason for this Selection.

The forest lies within the northern limits of the optimum range of sugar pine, and is one hundred and fifty miles north of the Stanislaus National Forest, where reconnaissance was carried on during the two summers previous. This location should disclose the effects of difference in latitude upon the occurrence and diversity of Ribes species and upon the composition of timber types.

B. General Description.

The Plumas National Forest is considered one of the important sugar pine forests of California. It lies on the west slope of the Sierra Nevada between Townships 20 N. and 28 N., and Ranges 5 E. and 17 E., Mt. Diablo Meridian and Base Line. It is drained by the Feather River system comprising the North, Middle and South Forks which unite in the foothills and empty into the Sacramento River. The North and Middle Forks have cut deep canyons in the Sierra plateau producing a rugged and much broken topography. These canyons, which in the western half of the forest are separated by granite ridges of 6,000 and 7,000 feet, in the eastern half open up into large valleys at elevations of 3,500 feet. The American Valley and Indian Valley are good examples of these.

The good system of roads existing on the Plumas provides access to all the sugar pine areas. The Western Pacific Railroad traverses the forest from west to east using the Feather River Canyon and American Valley. Quincy, a town of 700 population in the American Valley, is the county seat and headquarters of the Forest Supervisor, and was the base of supplies for the reconnaissance camp.

A Forest Experiment Station of the U. S. Forest Service is located five miles north of Quincy.

C. Detailed Location.

Reconnaissance was performed on five major and several minor areas of the forest, areas more or less naturally separable one from another. For the purpose of analysis of data they are combined into four because of similarity of conditions on and proximity of several of the areas. A description of each of these follows:

1. The Meadow Valley area, eight miles west of Quincy and occupying roughly a township and a half, supports one of the best stands of mature sugar pine on the forest. It comprises the Meadow Valley basin drained by Spanish and Meadow Valley creeks. Meadows occupy a large part of the basin, the timber being found on the bordering slopes which in some places are rugged and steep. Ownership of the timber is divided between the Federal Government and private holders. The Spanish Peak Lumber Company operates in the valley a mill of 75 M capacity per day, and has cut the timber from off the northern slopes.

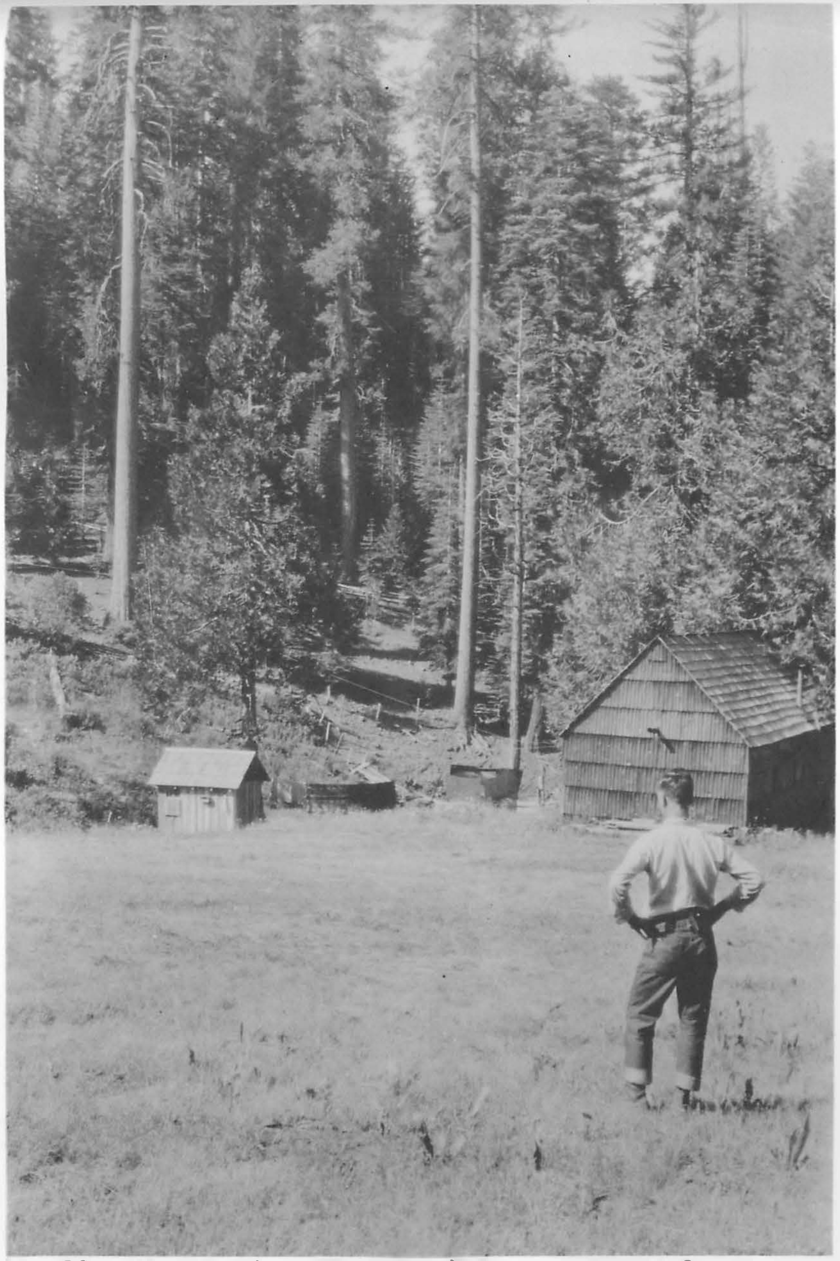
The species of Ribes are three: Ribes nevadense, Grossularia roezli, and G.inermis. The brush and undergrowth are composed of several species of manzanita and Ceanothus, western service berry, chinquapin, dogwood, cherry, scrub-oaks, and willow.

The basin exhibits a variety of timber types not found elsewhere. It was noted that soil changes produce abrupt changes in types in some localities.

Granite Basin, one and a half townships to the southwest, where nine sections were intensively reconnaissanced, is included in the Meadow Valley unit. It does not exhibit sufficient differences nor is it of sufficient importance to be classed as a separate unit.

2. Butterfly Valley and adjacent country nine miles north of Quincy is the second locality. It covers roughly half a township, has excellent stands of sugar pine, and is distinguished by a scarcity of Ribes and a comparative lack of water. R. nevadense and G.roezli are the only Ribes present. The amount of brush is small. The Murphy Lumber Company of Quincy is logging in the valley at present.

3. The third division consists of three areas, two of which, Long Valley and Round Valley, are contiguous, and the third, Butt Valley, lies west of these two across the North Fork of the Feather River. Again similarity of conditions causes them to be considered a unit. Long Valley is eight miles via a poor road west of Greenville, which is 22½ miles north of Quincy, and Round Valley is three miles west on the same road. At Long Valley is a fine stand of sugar pine on Federal land in which no logging has been carried on. In addition to the three species of Ribes found at Meadow Valley R. hallii and R. cereum grow here, a few bushes of the latter occurring on the higher



W. 26. Sugar Pine-Fir mixed type. Stanislaus National Forest, California.

W. 25. Typical Sugar Pine Crown (right). Stanislaus National Forest, California.

W. 37. Reconnaissance camp in Forest Service cutting. Meadow Valley, Plumas National Forest, California.

W. 28. Sugar pine-yellow pine type. Meadow Valley, Plumas National Forest, California.

points. Brush is prevalent and moderately dense.

Conditions at Round Valley are somewhat similar. The land is nearly all in private ownership and a reservoir occupies the valley proper.

Butt Valley, 25 miles west of Greenville and six miles south of Lake Almanor, is a region of broken and steep topography supporting fair sugar pine. A reservoir of the Great Western Power Company occupies the valley, but the adjoining timber is largely Government owned. The Ribes species are the same except that <u>R. cereum</u> does not occur; undergrowth generally is sparse.

4. The fourth division is designated at Mt. Hough, which is a lookout peak immediately northeast of Quincy. It includes the southern slopes of Mt. Hough, five sections north of the Middle Fork of the Feather River along the Quincy-La Porte road, and five sections at Poplar Valley 18 miles southeast of Quincy. Differences in conditions on them are small. Upon Mt. Hough is a good body of sugar pine largely Government owned. The five species of Ribes named above are present and brush is moderately dense.

III. Methods of Work.

A. Mechanical Routine.

The mechanics of intensive control reconnaissance used were the same as those employed during the field season of 1927 in California. Since a full discussion of this is to be found in Mr. Kenyon's annual report for 1927, "Control Reconnaissance on Federal Lands, California", it will not be duplicated here. The one-man crew working half a section per day using the strip system with sample plots, and the system of public land surveys, form the basis for the work. The data recording forms are identical with those in previous use.

In addition to the intensive work some 86 sections were worked extensively, to which data obtained by intensive reconnaissance can be applied. The method employed was to observe an area by means of field glasses from the several high points it might offer, and draw on a township map the topography and eradication types as well as they could be determined. Compass and pacing and the public land surveys were used to obtain direction and distance. Extensive reconnaissance was applied to the poorer more inaccessible lands bordering the bodies of good sugar pine.

B. Eradication Types.

Six principal timber trees compose the forest: sugar pine <u>(Pinus lambertiana)</u>, western yellow pine (<u>P. ponderosa)</u>, Douglas fir

(*Pseudotsuga taxifolia*), white fir (*Abies concolor*), incense cedar (*Libocedrus decurrens*), and red fir (*A. magnifica*). Yellow pine is usually found, on south and west exposures, and on dry sites, and fir types on north and east exposures, though by no means are they confined to these situations. Incense cedar is a habitant of dry sites, though found very generally throughout the forest. Red fir grows at elevations above 5,500 feet, and is logged to some extent.

The eradication types, which coincide with the timber types, also remained the same, though some have altered meanings and demand a word of explanation when applied to the Plumas. The types are much less distinct than those of the Stanislaus, slowly merging into one another so that often a wide zone of transition separates them. They are not strictly homogeneous. Sugar pine-yellow pine type (SP-YP Mature) often contains a large per cent of fir, and conversely yellow pine will frequently occur scattered throughout a sugar pine-fir stand (SP-F Mixed). Douglas fir and white fir generally are equally abundant in the forest. Sugar pine - fir types are designated as having mixed age classes, though all gradations from a mixed to a purely mature type can be found. Among minor types are classed mature, immature, and cut-over stands of pure yellow pine, pure fir (both red and white) and lodgepole stands, and unclassified burns. Minor types occur as a heading in the tabulations. At Meadow Valley Spanish Creek and Meadow Valley Creek develop wide gravelly bottoms as much as ten chains wide in some places. These bottoms are classed as stream type although they support few Ribes. As a rule the Plumas types are irregular and cover small areas, giving the type map an intricate appearance.

Here, as throughout the Sierra Nevada generally, yellow pine-oak types occur at elevations up to 3,500 feet, from 4,000 to 6,000 feet sugar pine types hold sway. These, in turn, merge into forests of red and white fir in association with western white pine (*Pinus monticola*) and lodgepole pine (*Pinus contorta*) at higher elevations.

C. Office Methods.

All reconnaissance data are transferred from section summary sheets to township work sheets approximately 14" x 14", where it is available for ready reference. Permanent township maps on a scale of 2" = 1 mile are made from the individual field section maps. Colored typing is used. Both the township maps and work sheets are kept in a lock-type post binder, indexed together by township and range. These constitute the permanent records of reconnaissance.

D. Personnel.

The reconnaissance personnel consisted of the project leader, five assistants and a cook. Three days were allotted to the training of the men.

IV. Work Performed and Results Obtained.

There follows a number of tables showing the amount of territory covered by the reconnaissance method, a table giving partial analyses of a part of the data obtained, and a table of costs. These figures apply only to the Plumas National Forest, California.

V. Statement and Analysis of Costs.

Table No. 6 gives an analysis of the costs of control reconnaissance on the Plumas National Forest.

One quarter of the cook's time was spent on office work at camp, hence one quarter of his salary is withdrawn from cooking charges and included with salary charges.

A. Composite man-day charges.

1. Intensive reconnaissance:

   358 man-days spent in taking field data.
   $3.133 average daily pay of men.
   $1,121.73 total labor charge against actual field work.

2. Extensive reconnaissance:

   16 man-days spent in taking field data.
   $5.00 daily pay of project leader.
   $80.00 total labor charge against actual field work.

3. Composite charges:

Net field cost of project -	$3,264.78
Net labor cost of project -	1,201.73
Composite balance	$2,063.05

Total man-days - 374.
Composite charge per man-day = $5.516

Total cost of man-days.
Intensive reconnaissance $3.133 + $5.516 = $8.649
Extensive reconnaissance $5.00 + $5.516 = $10.516

358 man-days @ $8.649 = $3,096.50, total cost of intensive reconnaissance.
16 man-days @ $10.516 = $168.28, total cost of extensive reconnaissance.

Intensive reconnaissance, 2 days per section, $17.30 cost per section.

Cost per acre $.0301
Extensive reconnaissance, 5.38 sections per day, $1.96, cost per section.

Cost per acre $.00313

VI. Recommendations for Future Work.

Regarding extensive reconnaissance it was often found difficult and sometimes impossible, under the method used, to type certain areas with even a fair degree of accuracy. This is due to the broken quality of the Plumas topography and the rapid changing of timber types within small areas. Long ridges of even slope are rare and good vantage points are often not to be found, so that comparatively small areas only can be mapped in a day. It would seem with this combination of mediocre accuracy and small amount of area possible, that where such conditions exist, it would pay to send a man twice through a section taking Ribes and type data. This method, while slow, is twice as fast as intensive reconnaissance, but a degree of confidence could be placed in the results which does not obtain at present. One difficulty, however, is that such sections as are extensively reconnaissanced are usually at a good distance from camp.

This discussion applies only to rough country such as is found on the Plumas where types change rapidly and are frequently indistinct.

TABLE NO. 1

PER CENT OF FOREST RECONNAISSANCED

Classification	Sub-totals		Totals	
	Average	Per Cent	Average	Per Cent
Gross area of forest			1,442,000	100.0
Gross area of SP types	485,000	100.0	485,000	33.6
Area recon.intensively	102,808	21.2		
Area recon.extensively	53,765	11.1		
Total area recon.	156,573	33.3		

TABLE NO. 2
SECTIONS WORKED IN WHOLE OR IN PART
RECONNAISSANCE, CALIFORNIA, 1928

Locality	T.	R.	Intensive Reconnaissance Sections by Number	Intensive Total Sec.	Intensive Total Acres	Extensive Reconnaissance Sections by Number	Extensive Total Sec.	Extensive Total Acres	Grand Total Sec.	Grand Total Acres
	22N	7E				4,5,8,9	4	2,560	4	2,560
	23N	6E	23.24,25,26,35	5	3,200	13	1	640	6	3,840
	23N	7E	19,29,30,32	4	2,560	26,27,28,33,34,35	6	3 840	10	6,400
	23N	9E	5, 6	2	1,280	7,8,17	3	1,920	5	3,200
Meadow	24N	8E	1,2,3,4,9,10,11,12,13,14,15,16,20 21,22,23,24,25,26,27,28,29,32 33,34,35,36	27	17,280				27	17,280
Valley	24N	9E	5,6,7,8,17,18,19,29,30,31,32	11	6,995	15,22,23,24,25,26,27,34,35,36	10	6,400	21	13,395
Butterfly Valley	25N	9E	16,17,19,20,21,22,23,25,26 27,28,29,30,31,32,33,34,35,36	18	10,843	5,6,7,8,19	5	2,880	23	13,723
	25N	9E	12,13,24	3	1,920				3	1,920
	23N	10E	3,4	2	1,280				2	1,280
	23N	11E	17,20,21,22,27	5	3,200	16,18,19	3	1,920	8	5,120
	24N	10E	2,3,9,10,33,34,35	7	4,480				7	4,480
Mt. Hough	25N	10E	7,15,16,17,18,20,21,22,27,28,29,32,33,34	14	8,960				14	8,960
	25N	8E	1,2	2	1,280	11,12,26,27,32,33,34,35,36	9	5,470	11	6,750
	26N	7E	1,2,3,4,5.8,9,10,11,12,13,14,15,16,22	15	8,656	6,7,17	3	1,920	18	10,576
	26N	8E	1,2,3,7,10,11,12,13,14,22,23,24,26 27, 28, 33, 34, 35, 36	19	12,160	6,8,18,20,25,29,31,32	8	5,120	27	17,280
	26N	9E	4,5,6,7,8,9,10,15,16,17,18,19,20 21,22,23,27,28,29,30,31	21	13,032	1,2,11,12,14,24,26,32,33,34	10	6,400	31	19,432
	27N	7E	31,32,33,35,36	5	3,122	26,28,29,30,34	5	2,855	10	5,977
	27N	8E	35,36	2	1,280	31	1	640	3	1,920
Long	27N	9E	31,32	2	1,280	11,12,13,14,15,22,23,24,25,26 27,34,35,36	14	8,640	16	9,920
Valley	27N	10E				29,30,31,32	4	2,560	4	2,560
TOTALS				164	102,808		86	53,765	250	156,573

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TABLE NO. 2
SECTIONS WORKED IN WHOLE OR IN PART
RECONNAISSANCE, CALIFORNIA, 1928

Locality	T.	R.	Intensive Reconnaissance			Extensive Reconnaissance			Grand Total	
			Sections by Number	Total Sec.	Total Acres	Sections by Number	Total Sec.	Total Acres	Sec.	Acres
	22N	7E				4,5,8,9	4	2,560	4	2,560
	23N	6E	23,24,25,26,35	5	3,200	13	1	640	6	3,840
	23N	7E	19,29,30,32	4	2,560	26,27,28,33,34,35	6	3,840	10	6,400
	23N	9E	5, 6	2	1,280	7,8,17	3	1,920	5	3,200
Meadow	24N	8E	1,2,3,4,9,10,11,12,13,14,15,16,20 21,22,23,24,25,26,27,28,29,32 33,34,35,36	27	17,280				27	17,280
Valley	24N	9E	5,6,7,8,17,18,19,29,30,31,32	11	6,995	15,22,23,24,25,26,27,34,35,36	10	6,400	21	13,395
Butterfly Valley	25N	9E	16,17,19,20,21,22,23,25,26 27,28,29,30,31,32,33,34,35,36	18	10,843	5,6,7,8,19	5	2,880	23	13,723
	25N	9E	12,13,24	3	1,920				3	1,920
	23N	10E	3,4	2	1,280				2	1,280
	23N	11E	17,20,21,22,27	5	3,200	16,18,19	3	1,920	8	5,120
	24N	10E	2,3,9,10,33,34,35	7	4,480				7	4,480
Mt. Hough	25N	10E	7,15,16,17,18,20,21,22,27,28,29 32 33 34	14	8,960				14	8,960
	25N	8E	1,2	2	1,280	11,12,26,27,32,33,34,35,36	9	5,470	11	6,750
	26N	7E	1,2,3,4,5,8,9,10,11,12,13,14,15,16,22	15	8,656	6,7,17	3	1,920	18	10,576
	26N	8E	1,2,3,7,10,11,12,13,14,22,23,24,26 27,28,33,34,35,36	19	12,160	6,8,18,20,25,29,31,32	8	5,120	27	17,280
	26N	9E	4,5,6,7,8,9,10,15,16,17,18,19,20 21,22,23,27,28,29,30,31	21	13,032	1,2,11,12,14,24,26,32,33,34	10	6,400	31	19,432
	27N	7E	31,32,33,35,36	5	3,122	26,28,29,30,34	5	2,855	10	5,977
	27N	8E	35,36	2	1,280	31	1	640	3	1,920
Long	27N	9E	31,32	2	1,280	11,12,13,14,15,22,23,24,25,26 27,34,35,36	14	8,640	16	9,920
Valley	27N	10E				29,30,31,32	4	2,560	4	2 560
TOTALS				164	102,808		86	53,765	250	156,573

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TABLE NO. 2
SECTIONS WORKED IN WHOLE OR IN PART
RECONNAISSANCE, CALIFORNIA, 1928

Locality	T.	R.	Intensive Reconnaissance: Sections by Number	Intensive Total Sec.	Intensive Total Acres	Extensive Reconnaissance: Sections by Number	Extensive Total Sec.	Extensive Total Acres	Grand Total Sec.	Grand Total Acres
	22N	7E				4,5,8,9	4	2,560	4	2,560
	23N	6E	23,24,25,26,35	5	3,200	13	1	640	6	3,840
	23N	7E	19,29,30,32	4	2,560	26,27,28,33,34,35	6	3,840	10	6,400
	23N	9E	5, 6	2	1,280	7,8,17	3	1,920	5	3,200
Meadow	24N	8E	1,2,3,4,9,10,11,12,13,14,15,16,20 21,22,23,24,25,26,27,28,29,32 33,34,35,36	27	17,280				27	17,280
Valley	24N	9E	5,6,7,8,17,18,19,29,30,31,32	11	6,995	15,22,23,24,25,26,27,34,35,36	10	6,400	21	13,395
Butterfly Valley	25N	9E	16,17,19,20,21,22,23,25,26 27,28,29,30,31,32,33,34,35,36	18	10,843	5,6,7,8,19	5	2,880	23	13,723
	25N	9E	12,13,24	3	1,920				3	1,920
	23N	10E	3,4	2	1,280				2	1,280
	23N	11E	17,20,21,22,27	5	3,200	16,18,19	3	1,920	8	5,120
	24N	10E	2,3,9,10,33,34,35	7	4,480				7	4,480
Mt. Hough	25N	10E	7,15,16,17,18,20,21,22,27,28,29,32,33,34	14	8,960				14	8,960
	25N	8E	1,2	2	1,280	11,12,26,27,32,33,34,35,36	9	5,470	11	6,750
	26N	7E	1,2,3,4,5,8,9,10,11,12,13,14,15,16,22	15	8,656	6,7,17	3	1,920	18	10,576
	26N	8E	1,2,3,7,10,11,12,13,14,22,23,24,26 27,28,33,34,35,36	19	12,160	6,8,18,20,25,29,31,32	8	5,120	27	17,280
	26N	9E	4,5,6,7,8,9,10,15,16,17,18,19,20 21,22,23,27,28,29,30,31	21	13,032	1,2,11,12,14,24,26,32,33,34	10	6,400	31	19,432
	27N	7E	31,32,33,35,36	5	3,122	26,28,29,30,34	5	2,855	10	5,977
	27N	8E	35,36	2	1,280	31	1	640	3	1,920
Long	27N	9E	31,32	2	1,280	11,12,13,14,15,22,23,24,25,26 27,34,35,36	14	8,640	16	9,920
Valley	27N	10E				29,30,31,32	4	2,560	4	2,560
TOTALS				164	102,808		86	53,765	250	156,573

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TABLE NO. 3
TYPE DIVISION OF TOTAL AREA RECONNAISSANCED.

Eradication Types	Acres	Per Cent
Sugar Pine Types:		
SP-YP Mature	72,625	46.4
SP-YP Cut-over	9,131	5.9
SP-F Mixed	51,241	32.7
SP-F Cut-over	2,536	1.6
Totals	135,533	86.6
Stream Types:		
Stream Mature	2,146	1.4
Stream Cut-over	124	0.1
Totals	2,270	1.5
Other Types:		
Brush	7,481	4.7
Meadow	4,052	2.6
Minor Types	7,237	4.6
Totals	18,770	11.9
GRAND TOTALS	156,573	100.0

TABLE NO. 4
TYPE DIVISION OF AREA WORKED EXTENSIVELY.

Eradication Types	Acres	Per Cent
SP-YP Mature	21,598	40.2
SP-YP Cut-over	2,360	4.4
SP-F Mixed	16,409	30.5
SP-F Cut-over	625	1.2
Stream Mature	230	0.4
Stream Cut-over	17	0.0
Brush	4,545	8.5
Meadow	2,389	4.4
Minor types	5,592	10.4
Totals	53,765	100.0

TABLE NO. 5

ACREAGE AND RIBES ANALYSIS OF AREA WORKED INTENSIVELY.
RECONNAISSANCE, CALIFORNIA, 1928

Part A. Meadow Valley and Granite Basin

Eradication Types	Acreage	Ribes Per Acre			
		R. nevadense	G. roezli	G. inermis	Totals
SP-YP Mat.	9,006	3.7	12.9	2.1	18.7
SP-YP CO.	3,207	0.2	7.2	3.3	10.7
SP-F Mix.	12,333	1.0	33.2	.9	35.1
SP-F CO.	1,590	0.5	33.9	0.0	34.4
Str. Mat.	882	99.0	16.1	26.0	141.1
Str. CO.	85	90.4	10.1	32.2	133.7
Brush	1,787	3.5	15.1	0.0	18.6
Meadow	1,046	2.9	6.4	34.8	44.1
Minor Types	1,379	6.2	3.3	6.4	15.9
Totals and Averages	31,315	5.1	20.9	3.6	29.6

Part B. Butterfly Valley

Eradication Types	Acreage	Ribes Per Acre		
		R. nevadense	G. roezli	Totals
SP-YP Mat.	6,399	1.4	1.2	2.6
SP-YP CO.	1,264	1.0	0.1	1.1
SP-F Mix.	2,758	26.0	9.2	35.2
SP-F CO.	50	0.0	0.0	0.0
Str. Mat.	79	184.1	3.8	187.9
Str. CO.	0	0.0	0.0	0.0
Brush	22	0.0	0.0	0.0
Meadow	206	0.0	0.0	0.0
Minor Types	65	0.0	0.0	0.0
Totals and Averages	10,843	8.9	3.1	12.0

Part C. Long Valley

Eradication Types	Acreage	Ribes Per Acre					
		R. nevadense	G. roezli	G. inermis	R. hallii	R. cereum	Totals
SP-YP Mat.	23,341	3.4	21.6	0.0	0.3	0.0	25.3
SP-YP CO.	211	0.0	103.0	0.0	0.0	0.0	103.0
SP-F Mix.	15,302	28.9	78.7	0.1	8.0	0.2	115.9
SP-F CO.	136	1.3	57.3	0.0	0.0	0.0	58.6
Str. Mat.	687	145.0	69.6	14.8	0.8	0.0	230.2
Str. CO.	4	515.0	280.0	0.0	0.0	0.0	795.0
Brush	768	20.7	52.7	0.0	0.0	0.0	73.4
Meadow	323	0.0	0.0	0.0	0.0	0.0	0.0
Minor Types	38	0.0	0.0	0.0	0.0	0.0	0.0
Totals & Averages	40,810	15.7	44.8	0.3	3.2	.07	64.0

Part D. Mt. Hough

Eradication Types	Acreage	Ribes Per Acre					
		R. nevadense	G. roezli	G. inermis	R. hallii	R. cereum	Totals
SP-YP Mat.	12,281	1.6	17.3	0.0	0.3	1.3	20.5
SP-YP CO.	2,089	0.9	21.7	0.0	0.0	0.0	22.6
SP-F Mix.	4,439	16.8	79.8	0.0	6.8	12.6	116.0
SP-F CO.	135	0.0	81.0	0.0	0.0	0.0	81.0
Str. Mat.	268	126.7	17.9	43.3	2.0	62.7	252.6
Str. CO.	18	378.4	116.2	126.7	0.0	0.0	621.3
Brush	359	11.9	18.6	0.0	0.0	1.3	31.8
Meadow	88	0.0	0.0	0.0	0.0	0.0	0.0
Minor Types	163	3.6	305.3	0.0	0.0	10.8	319.7
Totals & Averages	19,840	7.1	34.6	0.7	1.7	4.6	48.7

Part E. Average Ribes Per Acre on Entire Area Reconnaissanced

Eradication Types	Total Acreage	Average Ribes Per Acre					
		R. neva.	G. roez.	G. iner.	R. hallii	R. cereum	Grand Average
SP-YP Mat.	51,027	2.8	16.5	0.4	0.2	0.3	20.2
SP-YP CO.	6,771	0.6	13.3	1.6	0.0	0.0	15.5
SP-F Mix.	34,832	17.2	58.0	0.4	1.2	1.7	78.5
SP-F CO.	1,911	0.5	32.9	0.0	0.0	0.0	33.4
Str. Mat.	1,916	122.9	35.0	26.2	0.6	8.8	193.5
Str. CO.	107	154.7	38.0	46.9	0.0	0.0	239.6
Brush	2,936	9.0	25.3	0.0	0.0	0.2	34.5
Meadow	1,663	1.8	4.0	21.9	0.0	0.0	27.7
Minor Types	1,645	5.6	33.0	5.4	0.0	1.1	45.1
Totals & Averages	102,808	10.1	30.8	1.4	0.5	0.9	43.7

TABLE NO. 6
CONTROL RECONNAISSANCE COSTS

Classification	Sub-total Cost	Sub-total Per Cent	Total Cost	Total Per Cent
Salaries			$1,942.48	59.5
Subsistence*				
Supplies	675.53	74		
Transportation of supplies	32.92	4		
Cooking	202.50	22		
Totals	$910.95	100	$910.95	27.9
Travel				
Miscellaneous travel	55.19	52		
Transportation of men	28.11	26		
Scouting	23.28	22		
Totals	$106.58	100	$106.58	3.3
Equipment				
1926 prorated charge on equip.	15.19	5		
1927 " " " " "	74.61	25		
1928 " " " " -				
Equipment	32.92	11		
Supplies	37.73	12		
1928 freight charges	8.68	3		
1928 depreciation of truck No. 7	71.53	23		
Transportation in California	64.11	21		
Totals	$304.77	100	$304.77	9.3
GRAND TOTALS			$3,264.78	100.0

*Number of meals served - - 1,766
Cost per meal - - - -$0.516

EXPERIMENTAL RIBES ERADICATION CALIFORNIA, 1928

by

W. V. Benedict,
Junior Forester.

INTRODUCTION

During 1926 and 1927 experiments in Ribes eradication were carried on near Strawberry, chiefly on the Cow Creek, Herring Creek and Strawberry timber sale areas of the Stanislaus National Forest. Efforts were directed primarily on areas marked for cutting and various aged logged-off lands. At the close of the 1927 season it was deemed advisable to shift activities to a large area of typical virgin sugar pine forest. Data were needed on Ribes occurrence and working conditions, expressed in terms of cost of eradication per acre, for such areas to compare with results obtained on cut-over lands.

I. Purpose of Work.

The general purpose of the project was, as in the past, the continued acquisition of cost data and development of methods of work for the different associations in which sugar pine occurs. However, the 1928 work was aimed specially towards the development of suitable methods of eradication on areas of few Ribes and locating and blocking out areas containing no Ribes. Other points of accomplishment were:

(1) The further development of checking methods.
(2) The further development of pre-eradication methods.
(3) The continued training of personnel.

II. Location of Work.

A. Exact Location.

The area chosen for the 1928 work lies in the north half of the Stanislaus Forest, 27 miles above Angels Camp, California. More exactly, it occupies parts or all of the 16 sections centered around the intersection of townships 5 and 6, north, and ranges 15 and 16 east, Mt. Diablo Meridian.

It is drained by the North Fork of the Stanislaus River, San Antonio Creek, and their tributaries.

The area extends from the main divide of the Mokelumne-Stanislaus drainage down to the North Fork of the Stanislaus River, in

the four townships mentioned. (See map accompanying this report for exact limitations of eradication area.)

B. Reasons for Selection of Area.

Prior to the close of the 1927 season steps were taken to select the area for the following year's work. The reconnaissance data of the forest as well as records of the Forest Service, were thoroughly gone over. With this information scouting trips were made to areas showing promise of containing the necessary requisites for the work for 1928. The area described previously, centering around Dorrington, California was chosen for the 1928 experimental work for these reasons:

(1) This area contained a sufficiently large acreage of virgin sugar pine forest for the proper development of scouting work.

(2) It represented an area typical of the conditions in which sugar pine occurs on the forest.

(3) It was made readily accessible to work by a net-work of roads and trails.

(4) While predominately a sugar pine-yellow pine type, it contained a varied mixture of age classes, Ribes concentrations, brush species and timber species to permit the procuring of data and development of methods on areas of diverse working conditions.

C. Description of Conditions.

The area is situated on the lower west slopes of the Sierra Nevada at an elevation ranging from 4,500 feet to 5,500 feet. The topography is generally quite regular, being characterized by gently rolling slopes cut by the precipitous canyons of the Stanislaus River and San Antonio Creek. Numerous surface boulders and granite rock outcroppings occur on the different slopes. There is a heavy precipitation of snow during the winter months but the summers are long and dry.

Brush species are the same as encountered on the Strawberry area; namely spiny ceanothus, Manzanita, mountain lilac, chinquapin, scrub-oak, choke-cherry, service-berry, and bear-clover. Their occurrence varies with openings in the timber and direction of slope. Openings in the stand as the result of fire usually are heavily populated with brush, while the open yellow pine slopes contain but scattered clumps.

The entire area is classified as sugar pine type, sugar pine ranging from a scant 15% of the stand on the dry south slopes, to as high as 50 to 60% on the moist north and west slopes. Associated species are: yellow pine, incense cedar, white fir (Abies concolor) and black oak (Quercus californica).

The stand is largely a composition of all age classes, with a prevalence of dominant mature and over-mature trees. Timber types are not sharply defined, there occurring a mixture of species on the various slopes. The area as a whole is characterized by a predominance of sugar pine-yellow pine types; white fir being scattered more or less throughout the stand with occasional small patches of sugar pine-fir type.

D. Eradication Types.

In the past, eradication types (with the exception of stream type) have been synonymous with the timber types of the locality. Such types were usually limited by streams and ridges and determined by exposure. Each type represented more or less similar working conditions.

The Dorrington area retained these same type characteristics, though to a less marked degree. However, the large proportion of sugar pine-yellow pine type, in which occurred all age-classes and usually several timber species did not present a homogeneous area of working conditions. In places there were dense thickets of reproduction, other localities contained considerable brush, while still other localities would be open and park-like in appearance. Ribes occurrence varied likewise, from practically none on the open park-like slopes to several hundred per acre in the brush thickets.

Such a mixture of conditions within one timber type necessitated a change in eradication classifications. The first attempt at a change was to make a further division of the timber type, according to conditions, such as: s.p. -y.p-mixed for areas containing a many-aged stand; s.p.-y.p-open, for the open park-like slopes, and s.p.-y.p.-brush for the openings in the stand where brush species occurred. While this classification appeared quite satisfactory for conditions prevailing in the immediate locality, it was decided that such a method of designating eradication types would not fit a very large range of territory in the sugar pine belt.

The adoption of eradication classes, as described by Strong in his report on "Eradication on Federal Lands, Idaho, 1927" was next effected. This method of classifying eradication conditions was used throughout the remainder of the season.

E. Ribes species.

Grossularia roezli and Ribes nevadense were the only two Ribes species inhabitating the area.

R. nevadense confined itself largely to a narrow zone along streams. G. roezli occurred in all types, from an occasional withered veteran in the open yellow pine slopes to several hundred per acre along streams and in brush thickets. It constituted 94% of the total number of Ribes eradicated.

With the exception of a short time in the early summer, when the soil was moist and hand pulling could be resorted to, tools were required in eradicating all Ribes.

No attempt was made to eradicate the numerous seedlings of both species.

III. Methods of Work.

A. General Organization of Project.

The general organization of the project was essentially the same as in previous years. All equipment and camp supplies were procured from the Spokane Office. Subsistence supplies and other incidental supplies were purchased locally at Sonora. Transportation of camp supplies was by personal car and local agencies until July 21 at which time a Government truck was provided.

One twenty-eight man eradication unit was operated, divided into working units as follows: field supervisor, camp boss, two checkers, four three-man scout crews, two four-man crews, two crew foremen, cook and flunky.

Prior to any actual field work the proposed area near Dorrington was pre-eradicated (as described in the 1927 report of California eradication) and the data used as a basis for developing eradication plans. The area, as well as being mapped according to timber types, was subdivided into blocks or working units. Specially designed blister rust control boundary markers were used to permanently mark the corners of all blocks eradicated.

B. Crew Organization.

(1) Regular crews. Two four-man crews, with foreman checking behind, were employed on areas where working conditions were more or less severe and Ribes numerous. Such areas included stream type, brush patches and parts of the sugar-pine-fir type, in other words, in eradication classes C and D. Inexperienced men were used in the crews, supervised by an experienced foreman.

(2) Scout crews. Four three-man scout crews were used on areas permitting an open formation and rapid progress. Much of the sugar pine-yellow pine type, as well as part of the sugar pine-fir and a small bit of stream type, or eradication classes A and B, were worked by the scouting method. Men with former eradication experience, and those of the new men showing the most promise were used on scout crews.

Sixty nine per cent of the total area was worked by scout formation, 21% by regular crew formation and 10% blocked out as Ribes free by advance check.

(3) Best methods.

(a) The segregation of good and poor men in crew make-up, the poorer men grouped under a capable foreman and assigned to work on areas of numerous Ribes.

(b) The use of three-man crews on all areas when possible.

C. The Use of String.

Excepting along streams and on areas frequented by numerous tourists and live-stock, 2# cones of 3-ply grocer's twine were used in marking strip boundaries. The method used in laying string was simply for the end man to "jam" a cone of twine to the end of an eradication tool and proceed in his search for Ribes, paying only enough attention to the unwinding string to keep it advantageously placed.

D. Tools.

All eradication men were provided with grubbing tools to assist in removing the Ribes. All of the root system of each Ribes was removed wherever possible. Mattocks and grub hoes were used by members of the regular crews. Specially designed tools, lighter than the grub hoe and possessing a claw or pick on one end, were used by members of the scout crews. The Ninman pick was tried out but did not prove satisfactory.

E. Checking Methods.

The checking unit was composed of two experienced men. It was planned to make a uniform check on all eradicated areas but this program was interrupted near the close of the season by forest fire duty. However, of the 8,558.5 acres eradicated, 6,750.4 acres were advance checked and rechecked and an additional 1,150.2 acres were advance checked but not rechecked. Of the 6,750.4 acres completed, four per cent of the

area in stream type wase checked and one per cent of all remaining types was checked.

Check strips were established by running in compass lines every 20 chains across the eradication blocks. Each end of the check strip was permanently located and marked with the aid of aluminum tags. Each strip was divided into transects every two chains. Check strips were 1/4 chain wide. Transects were marked and numbered consectutively. All Ribes were recorded by species on alternate transects in stream type and on all transects in other types. Feet of live stem and height were taken for each Ribes recorded. After the area had been worked, the advance strips were rechecked and all missed bushes noted.

This advance check method of determining eradication efficiency was also effective in locating areas containing no Ribes. Ribes distribution on an advance checked area was determined by plotting Ribes found along strips in their proper transects. Wherever areas appeared to be Ribes free, and additional check strip, midway between those already run (resulting in strips every 10 chains across the block) wase established. The area around transects showing no Ribes was considered as Ribes-free and was eliminated from work. Scout crews covered only those portions of the block containing Ribes. By eliminating the need of sending an eradication crew over the entire block a material reduction in costs was effected. 845.8 acres, or 10% of the total area eradicated this year, were blocked out as Ribes free in this manner.

To check this method of blocking out Ribes free area, scout crews systematically worked over several such Ribes-free areas. The results substantiated the findings of the advance check strips to such an extent that the method was incorporated as a major part of the pre-eradication work for 1929.

F. Pre-eradication Methods.

Pre-eradication this year was done on parts of the Butterfly Valley and Meadow Valley working circles, of the Plumas National Forest.

Four experienced reconnaissance and eradication men, working in two-men crews, were used on pre-eradication.

The method employed this fall was essentially that described under advance checking. This area chosen for the 1929 eradication work was reconnaissanced during 1928. Strips once through each tier of 40's (or every 20 chains through a section) on which Ribes data were secured, were taken by the reconnaissance party. The pre-eradication crews located their advance check strips midway between two reconnaissance strips, thus obtaining Ribes data on every 10 chains across a section. Transects were permanently marked, and strip ends located with reference to section corners. In addition to Ribes data, the eradication class was determined for each transect, timber types were bounded and all physical features of importance located.

From the data thus obtained a working plan map on an 8 inches to the mile scale, was constructed, showing the timber types, Ribes distribution and eradication classes. A copy of this map is included with this report.

IV. Results of Work

A. Eradication.

The following tabulations (Tables 1,2 and 3) summarize the results of the eradication work for the season. In table No. 1 the block or working unit is the basis for compilations. Where it was feasible to do so blocks were so laid out as to contain but one timber type. On two blocks (7 and 8) two timber types are included in each. In table No. 2 eradication types, as described and used in 1927, are used for showing results of season's work. Table No. 3 summarizes the work by eradication classes. For a description of eradication classes refer to page 250, 1927 Annual Report.

TABLE NO. 1

Summary of Eradication by Blocks

Eradication Type	Block No.	Acres in Block	Number of Ribes Eradicated: G. roezli	Number of Ribes Eradicated: R. neva.	Number of Ribes Eradicated: Total	Number of Ribes Eradicated per Acre: G. roezli	Number of Ribes Eradicated per Acre: R. neva.	Number of Ribes Eradicated per Acre: Total	Time Spent Eradicating in Man Days: Crew-man	Time Spent Eradicating in Man Days: Fore-man	Time Spent Eradicating in Man Days: Scout	Time Spent Eradicating in Man Days: Total	Ribes Eradica-ted Per Man Day	Acres Erad. Per Man Day
Stream	1	99.25	26261	4115	30376	264.60	41.45	306.05	114.5	23.0		137.5	232.3	0.72
Stream	2	116.25	5782	4915	10697	49.6	42.3	91.9	66.25	2.0		68.25	156.7	1.70
SP-YP	4	1309.6	16204	804	17008	12.4	0.6	13.0	54.5		90.0	144.5	129.9	9.06
SP-YP	5	717.5	14509	59	14568	20.22	0.08	20.3	20.0		72.5	92.5	157.5	7.75
SP-YP	6	232.8	18202	13	18215	78.2	0.05	78.25	47.0	8.0	7.0	62.0	293.7	3.75
SP-YP and SP-F	7	821.3	95726	991	96717	116.5	1.2	117.7	316.0	58.0	24.0	398.0	243.0	2.06
SP-YP and SP-F	8	763.9	9239	133	9372	12.1	0.17	12.27	48.0	10.5	25.0	83.5	112.2	9.15
SP-YP	9	260.0	2391	434	2825	9.2	1.7	10.9	6.0	2.0	14.5	22.5	125.5	11.55
*SP-YP	9-A	377.9									2.0	2.0		188.95
Stream & SP-YP	10	702.3	7670	2856	10526	10.92	4.06	14.98	37.0	3.0	35.5	75.5	139.4	9.3
*SP-YP	10-A	467.9									2.0	2.0		233.95
SP-YP	11	1166.2	18520	932	19452	15.88	0.8	16.68	15.0		78.0	93.0	209.1	12.54
SP-YP	12	1523.6	37999	447	38446	24.94	0.29	25.23	130.0	14.0	37.0	181.0	212.4	8.42
Totals excluding blocked-out area	-	7712.7	252503	15699	268202	32.74	2.03	34.77	854.25	120.5	383.5	1358.25	197.46	5.67
Totals including blocked-out area	-	8558.5	252503	15699	268202	29.5	1.84	31.34	854.25	120.5	387.5	1362.25	196.88	6.28

*Blocked out as Ribes free by advance check.

TABLE NO. 2

Summary of Eradication Type

Eradication Type	Acres in Type	Ribes Per Acre	Time Spent on Ribes Eradicated			Time Spent on Eradication				Acres Per Man Day	Ribes Per Man Day	Percentage of Total		
			G. roezli	R. neva.	Total	Crew-man Days	Fore-man Days	Scout Days	Total			Acre-age	Work-ing Time	Ribes
Brush	86.7	297.89	25788	39	25827	63.75	5	11	79.75	1.09	323.85	1.01	5.85	9.63
Stream	266.7	183.08	37432	11396	48828	214.75	26	3	243.75	1.09	200.32	3.12	17.89	18.21
SP-Fir	986.9	43.0	40992	1446	42438	165.0	29	18	212.0	4.65	200.18	11.52	15.57	15.82
SP-YP	6372.4	23.71	148291	2818	151109	410.75	60.5	351.5	822.75	7.74	183.66	74.46	60.40	56.34
SP-YP Blocked out	845.8	-	-	-	-	-	-	4	4	211.45	-	9.89	0.29	-
Totals excluding blocked-out area	7712.7	34.77	252503	15699	268202	854.25	120.5	383.5	1358.25	5.67	197.46			
Totals including blocked-out area	8558.5	31.34	252503	15699	268202	854.25	120.5	387.5	1362.25	6.28	196.88	100	100	100

TABLE NO. 3

Summary of Eradication Classes

Eradication Class	Acres in Class	Ribes Per Acre	Ribes Eradicated			Time Spent on Eradication				Acres Per Man Day	Ribes Per Man Day	Percentages of Total		
			G. roezli	R. nevae	Total	Crew-man Days	Fore-man Days	Scout Days	Total			Acre-age	Work-ing Time	Ribes
Class D	283.7	351.49	93292	6425	99717	298.5	42	4	344.5	0.82	289.45	3.31	25.29	37.18
Class C	1513.7	73.28	103684	7244	110928	496.75	65.5	0	562.25	2.68	196.59	17.69	41.27	41.36
Class B	2931.6	14.06	39658	1554	41212	59.0	13	234	306.0	9.58	134.68	34.25	22.46	15.37
Class A	2983.7	5.48	15869	476	16345	0	0	145.5	145.5	20.51	112.33	34.86	10.69	6.09
Blocked-out Class A	845.8	-	-	-	-	0	0	4	4.0	211.45	-	9.89	0.29	-
Totals excluding Blocked-out area	7712.7	34.77	252503	15699	268202	854.25	120.5	383.5	1358.25	5.67	197.46			
Totals including blocked-out area	8558.5	31.34	252503	15699	268202	854.25	120.5	387.5	1362.25	6.28	196.88	100	100	100

B. Checking Results.

The following two tables summarize the results of the checking work for the 1928 season. The acreages shown in these tables are the total acres of the eradication area which were checked and rechecked, and should not be confused with the total area eradicated. Ribes per acre shown are based on advance check count and differ with Ribes per acre eradicated by crews. Feet of live stem figures were taken by checkers for the different slopes, types and blocks, as a part of their regular checking work.

Table No. 4 analyzes the efficiency of eradication for each of the several eradication blocks. Table No. 5 shows efficiency of eradication by type.

Eradication efficiency on SP-YP type was lower than efficiency on other types because these areas were largely worked by scout crews. Scout crews work at wide intervals and bushes missed are more apt to be large. SP-YP types as a rule support fewer Ribes than other types which always results in a lower percentage of efficiency.

Of the average total of 4.88 Ribes missed per acre there were but 2.78 bushes over six inches in height and only 0.69 bushes over 12 inches in height.

The feet of live stem for the average bush originally on the area was 12.41. For the average bush missed per acre it was 6.35 feet.

TABLE NO. 4

Efficiency of Eradication by Blocks

Blk. No.	Eradication Type	Acres of Block	Bushes Per Acre			Feet Live Stem Per Acre			Bushes Missed Per Acre			Feet Live Stem Missed Per Acre			Efficiency		Acres Checked	Per Cent of Check
			G. roezli	R. neva.	Total	G. roezli	R. neva.	Total	G. roezli	R. neva.	Total	G. roezli	R. neva.	Total	By No. of Bushes	By Ft. Live Stem		
1	Stream	99.25	245.6	50.9	296.5	2,135.0	983.70	3,118.70	7.22	6.11	13.33	13.33	13.56	26.89	95.50	99.10	5.4	5.4
2	Stream	116.25	43.6	55.5	99.1	370.45	2,331.34	2,701.79	3.88	5.97	9.85	11.64	66.86	78.50	90.06	97.09	3.4	2.9
4	SP-YP	1,309.6	28.7	0.8	29.5	289.19	9.95	299.14	2.55	0	2.55	11.40	0	11.40	91.35	96.19	11.8	0.9
5	SP-YP	717.5	17.1	0	17.1	266.21	0	266.21	6.21	0	6.21	55.15	0	55.15	63.77	79.28	8.1	1.1
6	SP-YP	232.8	35.1	0	35.1	43.09	0	43.09	4.29	0	4.29	24.86	0	24.86	87.80	94.23	3.5	1.5
7	SP-YP-Fir	821.3	100.15	2.68	102.83	929.29	3.62	932.91	8.82	0.31	9.13	39.12	0.31	39.43	91.12	95.78	6.4	0.8
8	SP-YP-Fir	763.9	29.53	0.12	29.65	349.07	0.12	349.19	2.56	0.12	2.68	13.49	0.12	13.61	90.98	96.14	8.6	1.1
11	SP-YP	1,166.2	14.61	0.30	14.91	170.26	1.05	171.31	3.07	0	3.07	41.19	0	41.19	79.40	75.95	13.2	1.1
12	SP-YP	1,523.6	17.64	0.15	17.79	290.63	2.80	293.43	2.80	0	2.80	21.84	0	21.84	84.23	92.56	13.6	0.9
All		6,750.4	46.00	6.70	52.70	473.35	180.42	653.77	4.12	0.76	4.88	26.91	4.09	31.00	90.74	95.26	73.8	1.1

NOTE: Blocks 10 and 10A were pre-checked, but were not rechecked.
Blocks 9 and 9A were not checked.

TABLE NO. 5

Efficiency of Eradication by Types

Eradication Type	Acres of Type	Bushes Per Acre			Feet Live Stem Per Acre			Bushes Missed Per Acre			Feet Live Stem Missed Per Acre			Efficiency		Acres Checked	Per Cent of Check
		G. roezli	R. neva.	Total	G. roezli	R. neva.	Total	G. roezli	R. neva.	Total	G. roezli	R. neva.	Total	By No. of Bushes	By Ft. Live Stem		
Stream	215.5	168.23	52.69	220.92	1,460.57	1,499.66	2,960.23	5.94	6.06	12.00	12.69	34.17	46.86	94.57	98.42	8.8	4.06
SP-YP	4,949.7	20.62	0.30	20.92	264.67	3.37	268.04	3.47	0.00	3.47	30.16	0	30.16	83.42	88.75	50.1	1.01
SP-YP-Fir	1,585.2	59.53	1.21	60.74	595.52	1.61	597.13	5.22	0.20	5.42	24.35	0.2	24.55	91.08	95.89	14.9	0.94
Total	6,750.4	46.00	6.70	52.70	473.35	180.42	653.77	4.12	0.76	4.88	26.91	4.09	31.00	90.74	95.26	73.8	1.1

C. Pre-eradication Results.

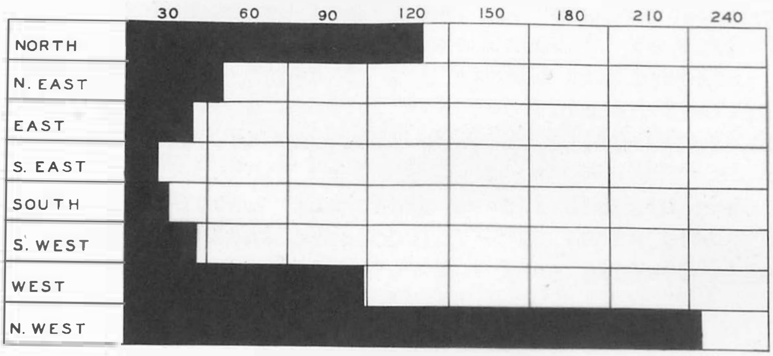
There were a total of 8,640 acres of sugar pine type pre-eradicated this season on the Plumas National Forest, 6,400 acres of which were on the Meadow Valley working circle and 2,240 acres on the adjoining Butterfly Valley working circle.

The analyzed results of the pre-eradication work constitute the major part of the 1929 eradication working plan and are taken up in detail in a supplementary report.

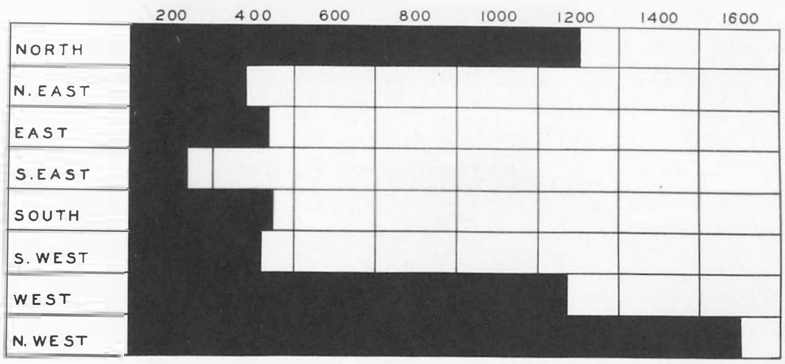
D. Special Studies.

(1) The effect of exposure on Ribes growth. This study was undertaken in conjunction with the advance checking work. Since most of the eradication area this year was situated on a southeast slope the results of the study are chiefly of local significance. Other slopes noted were principally those resulting from secondary drainage. A graphic illustration of the results is here shown.

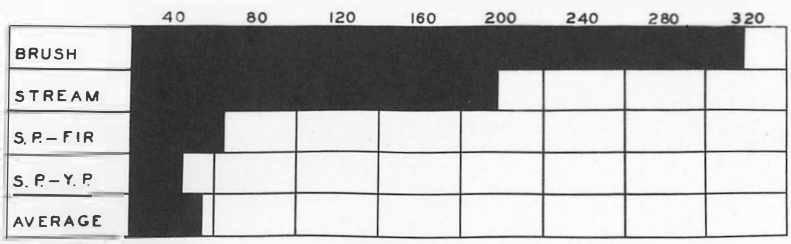
EFFECT OF EXPOSURE ON RIBES GROWTH
BY NUMBER OF BUSHES PER ACRE



EFFECT OF EXPOSURE ON RIBES GROWTH
BY FEET OF LIVE-STEM PER ACRE



EFFECT OF TYPE ON RIBES GROWTH
BY NUMBER OF BUSHES PER ACRE



1928 ANNUAL REPORT
W.V.B. 12–1–28

(2) Re-eradication. This study was undertaken for several reasons:

(a) To impress upon the crews the importance of careful work.
(b) To check the results of the checking work.
(c) To gain an idea of cost of re-eradication.

A total of 215.6 acres was re-worked. This acreage was distributed over the entire eradication area and was an average sample of all working conditions encountered. Prior to re-eradication the checking data showed 4.88 Ribes missed per acre. A total of 26.8 man days (2foreman, 8 crewmen and 16.8 scout) was required to re-work the 215.6 acres. There were 984 Ribes found on the second eradication, or an average of 4.56 per acre. The cost of the job totaled $147.14 or $0.68 per acre, as against the original cost of $1.00 per acre.

(3) Root and Crown Plots. The plots established in 1926 and 1927 were re-examined. As was noted previously, only those plants containing parts of crowns showed any signs of growth. If a part of a crown was left the plant quickly reestablished itself.

One of the biggest problems confronting the eradication work in California is to eliminate the return of Ribes by sprouting. Eradication crews are instructed to take out all roots and yet Ribes sprouts are numerous, especially along streams. On a thirty-acre plot in stream type there were checked 369 Ribes or 12.3 per acre, all having sprouted since eradication six weeks previously. Sprouting is not so abundant in other types, but nevertheless a serious factor to be considered in eradication work.

V. Cost of Eradication.

A. Total Net Field Cost.

All costs incurred by the project, property chargeable against the field work, are included in the following table, which is the basis for all cost computations. Acreage cost figures for the different types and classes are figured from the total net cost of $8,539.19.

TABLE NO. 6

Eradication Costs

I. PAYROLL	
1. Supervision (Salaries and expense of Supervisor and camp boss for time actually spent on job)	$845.01
2. Labor (Salaries paid by this office to all temporary men)	4,325.79
II. SUBSISTENCE	
1. Cost of supplies (at Sonora)	1,763.71
2. Transportation of supplies (from Sonora to B.R.Camp)	79.78
3. Cost of cooking (cook and helpers' salary)	600.00
III. TRANSPORTATION OF MEN	34.84
IV. EQUIPMENT	
1. 1/3 of 1928 purchase	76.65
2. 1/3 of 1927 purchase	173.55
3. 1/3 of 1926 purchase	35.34
4. Supplies not subsistence	87.76
5. String	108.18
6. Transportation of equipment	48.05
7. Depreciation on Gov't truck (based on a life of 20,000 miles)	107.65
8. Miscellaneous (laundering blankets, storage of equip., etc.)	61.07
V. PRE-ERADICATION COST	259.67
Total field cost	$8,607.05
Vistors' meals	67.86
Net cost	$8,539.19

B. Composite man day charges.

Composite man day costs are costs making up the "overhead". They include all costs excepting the salaries paid to the men while actually digging Ribes. Under composite costs are grouped supervision, subsistence, transportation, salaries of men for other than eradication work, equipment costs, checking, and pre-eradication costs.

Computations follow:

854.25 crewman days @ $2.70 per day	=	$2,306.475	
120.50 foremen days @ $3.20 " "	=	385.600	
387.50 scout days @ $3.11 " "	=	1,205.125	
1,362.25 total man days spent on erad.		$3,897.20	Salary charge for actual eradication.

8,539.91 - total net field cost.
3,897.20 - eradication salary cost.
$4,642.71 - composite balance.

Since the men actually doing the eradication work must bear all the "overhead" charge this composite balance, on a man day basis is added to the mens' salaries.

$$\frac{4642.71}{1362.25} = \$3.4075 = \text{composite charge per man day.}$$

$2.70 + 3.4075 =	$6.1076	total cost of	crewman day.
3.20 + 3.4075 =	6.6076	" " "	foreman day.
3.11 + 3.4075 =	6.5176	" " "	scout day.

$$\frac{8539.91}{1362.25} = \$6.268 \text{ cost of average man day.}$$

Costs for the different types are determined from these figures.

C. Cost of Eradication.

Tables 7 and 8 show the cost of eradication for the different eradication types and eradication classes respectively.

D. Cost of Checking.

(1) Salaries	$341.96	
(2) Subsistence	141.75	(363 meals @ $.39 per meal)
(3) Overhead	114.14	(general camp overhead prorated on basis of man days)
Total cost	$597.67	(This cost included in eradication cost)

Cost per acre = $0.075 (This includes cost of advance checking and rechecking on 6750.4 acres, and advance checking on an additional 1150.2 acres.)

Of this acreage cost, $0.04 was for advance checking, $0.032 for rechecking and $0.003 for summarization of data in camp.

E. Cost of Pre-eradication.

(1) Salaries	$332.61	
(2) Subsistence	82.73	(Cost of food at Quincy)
(3) Transportation	9.42	(Operating expense of Gov't. car)
(4) R.R. travel	44.95	(To and from Quincy where Gov't truck was not used)
(5) Supplies	16.00	(Tags for marking transects)
Total cost	$485.71	

Cost per acre - $0.055

F. Meal Costs

(1) Meals served.

Eradication	5,727
Cooking	276
Ecology	64
Checking	363
Visitors	110
Total	6,540

(2) Cost per meal.

Cost of food	$1,763.71
Cost of transportation of food	79.78
Salaries of cook & flunky	600.00
*Cost of meals served cook and flunky	103.12
Total subsistence cost	$2,546.61

Cost per meal - $0.39

*In previous years meals served to cook and flunky were charged against the general eradication project and not included as a cost against cooking. This results in a slightly lower meal cost, amounting to $0.37 this year. However, cost of meals served to the cooking staff is a justifiable charge against their work and should be so included.

TABLE NO. 7

Cost of Eradication by Types

Type	Ribes Acreage	Ribes Per Acre	Time Spent on Eradication: Crew-man Days	Fore-man Days	Scout Days	Total	Cost Per Type	Cost Per Acre	Cost Per Bush	Per Cent of Total Cost
Brush	86.7	297.89	63.75	5	11	79.75	$ 494.09	$5.70	$0.019	5.97
Stream	266.7	183.08	214.75	26	3	243.75	1502.95	5.64	0.031	17.60
SP-Fir	986.9	43.00	165.00	29	18	212.00	1316.69	1.33	0.031	15.42
SP-YP	6372.4	23.71	410.75	60.5	351.5	822.75	5199.39	0.82	0.035	60.89
*Blocked out	845.8	-	-	-	4	4	26.07	0.03	-	.30
Totals including blocked out area	8558.5	31.34	854.25	120.5	387.5	1362.25	$8539.19	$1.00	$0.032	100
Excluding blocked out area	7712.7	34.77	854.25	120.5	383.5	1358.25	$8513.12	$1.10	$0.031	100

*SP-YP type, when included with SP-YP type worked by crews, results in $0.72 per acre cost.

TABLE NO. 8.

Cost of Eradication by Classes

Class	Acreage	Ribes Per Acre	Time Spent on Eradication				Cost Per Class	Cost Per Acre	Cost Per Bush	Per Cent of Total Cost
			Crew-man Days	Fore-man Days	Scout Days	Total				
Class - D	283.7	351.49	298.5	42.0	4	344.5	$2126.70	$7.50	$0.021	24.90
Class- C	1513.7	73.28	496.75	65.5	0	562.25	3466.75	2.29	0.031	40.59
Class - B	2931.6	14.06	59.0	13.0	234	306.0	1971.36	0.67	0.048	23.08
Class - A	2983.7	5.48	0	0	145.5	145.5	948.31	0.32	0.058	11.13
* Blocked out	845.8	-	0	0	4	4	26.07	0.03	-	.30
Totals including blocked-out area	8558.5	31.34	854.25	120.5	387.5	1362.25	$8539.19	$1.00	$0.032	100
Excluding blocked-out area	7712.7	34.77	854.25	120.5	383.5	1358.25	$8513.12	$1.10	$0.031	

*Class A, when included with Class A worked by crews, results in $0.26 per acre cost.

<u>NOTE</u>: Of the average cost of $1.00 per acre, $0.075 is for checking and $0.024 for pre-eradication.

VI. Recommendations for 1929 Work.

In 1929 experimental Ribes eradication will be shifted to the Plumas National Forest. Conditions influencing eradication work will be different from those of the Stanislaus Forest. The three years' experience on the Stanislaus Forest has resulted in the development of methods of work applicable to Stanislaus conditions. These methods may or may not prove the most effective on the Plumas.

It is, however, recommended that the methods of work showing as most satisfactory on the Stanislaus Forest be employed at the start of the 1929 season on the Plumas. These methods are:

(1) The use of three-man crews wherever possible.

(2) The use of string as guide trail.

(3) The use of advance check strips in determining working conditions, Ribes distribution and efficiency.

(4) The use of eradication classes and timber types in denoting working conditions.

(5) The use of advance check strips in blocking out Ribes-free areas.

It may be necessary to modify the above methods to suit the working conditions of the Plumas but this can only be done after experience.

Modifications in the types of eradication tools used on the Stanislaus will be necessary from the start. The rocky nature of the whole Plumas terrain will require tools fitted with some type of pick arrangement for effectively extracting the Ribes.

It is also recommended that plot studies be started for the purpose of obtaining information on Ribes such as root and crown sprouting and seedling occurrence.

PRE-ERADICATION, 1928
PLUMAS NATIONAL FOREST

by
W. V. Benedict
Junior Forester

The following report is presented for the special purpose of showing, by illustration and description of methods, the use of control reconnaissance data in preforming the pre-eradication work.

I. Purpose of Work

Pre-eradication is an intensive Ribes survey of an area for the purpose of obtaining the necessary field data for formulating blister rust control measures.

The pre-eradication work was preformed last fall with three special objectives in mind, namely:

1. To utilize to the fullest extent the control reconnaissance data of an area in planning an eradication job.

2. To delimit areas containing too few Ribes to constitute a menace to sugar pine.

3. To establish advance check strips on the area from which the efficiency of the eradication work can be accurately determined.

II. Location of Area

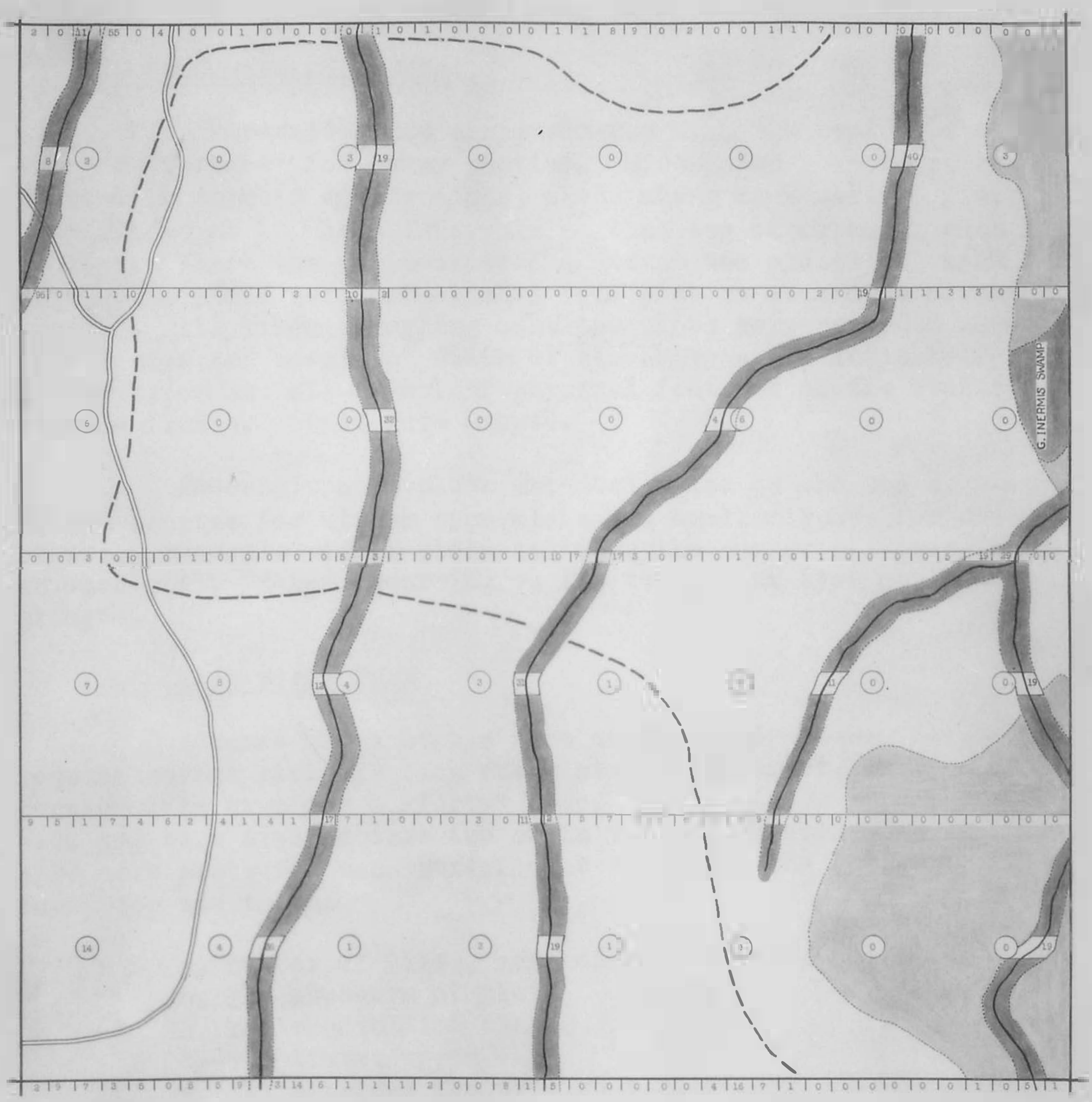
The area chosen for the 1929 experimental eradication work is located in the Butterfly Valley and the Meadow Valley working circles of the Plumas National Forest, between the Middle and North Forks of the Feather River. Exact locations are:

Butterfly Valley Area:	Sections 20,28, N½-21, S½-16 and S½-17, T. 25 N., R. 9 E., Mt. Diablo Meridian.
Meadow Valley Area:	Sections 16, 21, 22, 25, 26, 27, 28, N½-35, N½-36, T. 24 N., R. 8 E., and sections 30 and 31, T. 24 N., R. 9 E.

These sections are typical of the general working conditions, Ribes occurrence and sugar pine growth existing in the sugar pine type of the northern Sierra region.

III. Method of Work

The pre-eradication method used was designed not only to supply field information for planning the eradication operation but to facilitate the necessary eradication jobs of blocking out Ribes free areas and establishing advance check strips. This method was essentially that of establishing advance check strips mid-way between the control reconnaissance strips and utilizing the Ribes and mapping data of both in devising eradication working plans. The following map of a sample section (section 26) of the pre-eradication area illustrates the use of the combined reconnaissance and advance check strip data in constructing an eradication working plan map.



PRE-ERADICATION AND RECONNAISSANCE

SECTION 26, T.24 N R.8 E., MT. DIABLO MERIDIAN

LEGEND

0 | 3 | 0 PRE-ERADICATION STRIPS DIVIDED INTO TRANSECTS

0 3 RECONNAISSANCE PLOTS

RECONNAISSANCE STREAM TYPE PLOTS

TYPE BOUNDARY

STREAM TYPE

SUGAR PINE-YELLOW PINE TYPE

SUGAR PINE-FIR TYPE

BOUNDARY OF AREA ELIMINATED FROM CREW WORK

Annual Report 1928
W. V. Benedict.
February 13, 1929.

The following methods were used in securing field data:

1. Reconnaissance Data

A reconnaissance strip was run thru the center of each tier of "forties" for every section. Ribes data were taken on eight 1/10 acre ($\frac{1}{4}$ ch. by 4 ch.) plots along each strip. Plots were placed at 10 chain intervals so that two occurred in each "forty". Where the strip crossed a stream two additional 1/10 acre Ribes plots were established (one plot on each side of the stream). All Ribes occurring on these plots were recorded according to size and species. Width of stream-type was indicated. Timber types and all important physical features of the country visible from the strip were mapped.

Reconnaissance plots are designated on the map by unshaded squares for stream type plots and small circles for all others. Numerals within plots indicate the number of Ribes found on each plot. Ribes occurring on the two stream type plots are grouped.

2. Check Strip Data

Advance check strips were established mid-way between the reconnaissance strips. Each check strip, therefore, falls along a section line or along a "forty" line. Check strips were $\frac{1}{4}$ chain wide and were divided into two chain transects, resulting in forty 1/20 acre plots for each strip. For each plot the following information was taken:

a. Number of Ribes, according to species and size.
b. The exposure of plot.
c. The eradication class.
d. The timber type.
e. All physical features were noted.

Two 2-man crews were employed in obtaining the check strip data. Each crew completed two miles of check strip a day. The duties of the crewmen were: One man ran the compass, paced the distances, affixed transect tags and marked line. The other man recorded Ribes and made the map.

Transects were numbered consecutively from 1 to 40. The end of each transect was marked by a cardboard tag bearing the strip number and the transect number. Small aluminum tags were placed on twigs and

branches of trees to assist in relocating check strips. Both ends of check strips were permanently marked and tied-in along the section lines.

Check strips are shown on the map in their proper location. Each strip is divided into forty equal parts, each segment representing one transect. The number of Ribes occurring in each transect are denoted by the numerals.

IV. Results of Work

The combined reconnaissance and check strips, distributed every ten chains across a section furnished not only data for an accurate working map, but supply a diagrammatic distribution picture of Ribes conditions.

The heavy broken line on the map illustrates the use of the Ribes distribution data in delimiting Ribes free areas. The area east of the heavy broken line, with the exception of stream type and a short distance up the slope immediately adjacent to the stream type, contains so few Ribes that eradication work is not necesary. The area to the west contains a general distribution of Ribes and must be systematically covered by eradication crews. The class designations for the area requiring eradication will determine the type of crew formation best suited to work the area.

The eradication class acreage for the various sections was computed in the following manner: The eradication class for each transect or 1/20 acre plot along the check strip was determined by the field man. The four check strips contain a total of 160 transects. Transects of like designation were grouped and their percentage of 160 figured. These percentages of the acreage of the section gave the acreage of each class for the section.

The computed data for section 26 are:

TABLE NO. 1

Class	Acreage	No. of Ribes Per Acre	Type of Crew Work
A	336.0	0.7	No crew work necessary
B	104.3	13.1	Intensive scout crew work
C	139.5	56.2	Extensive crew work
D	60.2	470.7	Intensive crew work(str.type & brush areas
Total	640.0	59.0	

The results of the entire pre-eradication job, determined according to the above method are:

TABLE NO. 2

BUTTERFLY VALLEY AREA

	Eradication Class								Entire Section	
	Class A		Class B		Class C		Class D			
Section	Acres	Ribes Per Acre	Acres	Ribes Per Acre	Acres	Ribes Per Acre	Acres	Ribes Per Acre	Acres	Ribes Per Acre
S½ 17	244.2	2.0	43.8	29.1	32.0	132.5	0	-	320	18.8
N½ 21	296.0	4.6	24.0	36.6	0	-	0	-	320	7.0
28	640.0	0	0	-	0	-	0	-	640	0
20	600.3	0.1	23.7	26.6	16.0	55.0	0	-	640	2.5
S½ 16	276.2	2.9	24.0	32.2	19.8	98.0	0	-	320	11.0
Total	2,056.7	1.3	115.5	31.0	67.8	118.4	0	-	2,240.0	6.0

TABLE NO. 3

MEADOW VALLEY AREA

	Eradication Class								Entire Section	
	Class A		Class B		Class C		Class D			
Section	Acres	Ribes Per Acre	Acres	Ribes Per Acre	Acres	Ribes Per Acre	Acres	Ribes Per Acre	Acres	Ribes Per Acre
21	183.7	0.8	115.8	22.7	188.2	108.0	152.3	400.5	640	132.3
26	336.0	0.7	104.3	13.1	139.5	56.2	60.2	470.7	640	59.0
28	92.2	1.6	156.2	18.7	204.1	116.1	187.5	304.7	640	131.5
31	87.7	0	108.2	5.9	220.1	71.7	224.0	283.6	640	124.9
25	403.9	1.9	131.8	21.9	104.3	106.1	0	-	640	23.0
22	227.8	2.5	172.2	14.0	160.0	152.0	80.0	1088.0	640	91.7
27	307.8	1.0	152.4	23.1	144.0	142.2	35.8	257.8	640	52.5
30	416.0	0.8	67.8	14.2	115.8	92.4	40.4	316.0	640	38.4
16	424.3	0.6	80.0	13.0	83.9	142.0	51.8	358.4	640	47.7
N½ 36	144.0	0	64.0	10.0	100.2	84.0	11.8	313.3	320	40.0
N½ 35	8.0	0	92.2	1.2	168.0	72.3	51.8	186.1	320	66.2
Total	2631.4	1.1	1244.9	16.3	1628.1	91.5	895.6	344.6	6400	75.4

V. Cost of Pre-eradication Work

The following costs represent the cost of taking only the advance check strip data. No reconnaissance costs are shown.

1. Salaries	$332.61	(for time of men engaged on the job.)
2. Subsistence	82.73	(cost of food at Quincy.)
3. Transportation	9.42	(operating expense of Government car.)
4. Railroad travel	44.95	(to and from Quincy where Government truck was not used.)
5. Supplies	16.00	(tags used in marking check strips.)
Total cost	$485.71	

Cost per acre $ 0.055

The extent to which the pre-eradication data is used in facilitating the checking work and in delimiting Ribes free areas on the eradication project will determine the amount of the pre-eradication costs properly chargeable against these jobs.

REPORT ON QUARANTINE INSPECTION IN THE WEST-SPRING, 1928

by
C. R. Stillinger
Associate Pathologist

1. Points of Inspection

Quarantine inspection was carried on at the usual inspection points in the West during March and April except at Seattle. At this point inspection was continued throughout the winter. The inspection work at Salem and Eugene, Oregon, was for only a short period during the investigation of conditions in Oregon. The season was divided between Ogden, Utah, and Pocatello, Idaho, the work having been closed at Pocatello on May 15.

2. Results of Inspection

Table No. 1 gives a summary of the inspectors' observations during the season. Some effort was made to record all shipments of Ribes or pine which the inspectors observed. However, due to volume of the inspection work, the fact that the inspectors were new men and, finally, that recording these data were considered only as incidental part of the work and was not very greatly stressed, the information is not complete. Only a few records of intrastate shipments were made. Likewise the loose parcel post information is inaccurate because a large percentage of the inspection work was done in the terminals. With the exception of Portland the loose parcel post recorded is shipments observed on trains and trucks. In the case of Portland, all parcel post was recorded as loose parcel post. Probably about 25 per cent of the packages inspected at Portland are what would be listed as loose parcel post.

TABLE NO. 1

Plant Shipments Inspected -- Spring, 1928

Inspection Point	Period of Inspection	No. Ribes or Pine Shipments from			Number Inspected	Number Not Inspected	No. of Violations		Shipments Reported to States	No. Loose Parcel Post
		EQZ	WOZ	NOZ			State	Federal		
					Parcel Post					
Spokane	2-27,5-5-28	2	21	13	12,113		5	3	8	3,188
Portland	3-1,4-30-28	1	17	7	8,063		7	7		8,063
Seattle	1-1,4-30-28		36	4	11,552		6	8		
Tacoma	2-24,4-30-28		19	1	1,506		1	1	15	970
Ogden	3-9,4-12-28			6	309	7		1	5	171
Pendleton	2-28,4-27-28		5	4	801	25				202
Salem	3-13,3-17-28				58					58
Eugene	3-22,3-27-28				34					34
Pocatello	4-13,5-12-28			6	256					256
Total		3	98	41	34,692	32	19	20	28	12,942
					Express					
Spokane	2-27,5-5-28	1	7	1	2,058			3	1	
Portland	3-1,4-30-28	4	8		1,955		7	5		
Seattle	1-1,4-30-28		6	1	2,048					
Tacoma	2-24,4-30-28		8		536	20			29	
Ogden	3-9,4-12-28			2	428	13			1	
Pendleton	2-28,4-27-28		1	3	1,465	1		1	179	
Salem	3-13,3-17-28				57					
Eugene	3-22,3-27-28				8					
Pocatello	4-13,5-12-28				557				1	
Total		5	30	7	9,112	34	7	9	211	
					Freight					
Spokane	2-27,5-5-28				308				156	
Portland	3-1,4-30-28			1	84					
Seattle	1-1,4-30-28				0					
Tacoma	2-24,4-30-28				28					
Ogden	3-9,4-12-28				3	17			15	
Pendleton	2-28,4-27-28				69	41			50	
Salem	3-13,3-17-28				2					
Eugene	3-22,3-27-28				4					
Pocatello	4-13,5-12-28				12	9			9	
Total				1	510	67			230	

Table No. 2 gives a record of the violations which were intercepted, classified according to the class of shipper, means of transportation, and content of shipment.

Besides the violations of Quarantine 63 recorded in the table, seven violations of Quarantine 53 and two of Quarantine 62 were observed. All were shipments by private parties. No special report was made on most of the violations of Quarantine 53 because they were found while working in conjunction with the state inspector. The only report made by the Federal inspector was a notation of the observation on his daily report.

TABLE NO. 2

QUARANTINE VIOLATIONS

Shipper	Transporting Agency	Federal No. 63		State	
		Number Violations	Number Ribes	Number Violations	Number Ribes
Nursery	Parcel Post	7	67	8	83
	Express	7	250	7	142
	Freight				
Individual	Parcel Post	15	91	11	24
	Express	1	8		
	Freight				
Total		30*	416	26	249

* One violation reported from St. Paul.

Violations	Federal Quarantine No. 63	- 30
"	Oregon State No. 5	- 15
"	State of Wash. Order	- 11
	Total	56

Federal Violations by Nurserymen	- 14
" " " Individuals	- 16
State Violations by Nurserymen	- 15
" " " Individuals	- 11
Total	56#

No shipments of black currants or white pine were observed.

3. Period of movement of Ribes

During the period of inspection in the West a record was made of Ribes shipments observed in transit. The information may not be complete but enough records were made to obtain some idea as to the principal period of shipment of these plants. Grouping the reports from all inspection points by weeks the following information is secured;

Date	Number Shipments Observed
March 1-7	8
" 8-14	22
" 15-21	20
" 22-27	23
" 28- April 4	25
April 5-11	28
" 12-18	17
" 19-25	8
" 26- May 2	14

This data indicates that for this season the period of Ribes shipment in the spring is during the last three weeks of March and the first two in April.

4. Method of transportation of Ribes

It is also of interest to note the means of shipment for the 185 cases recorded in Table 1. The following table gives a summary of this phase of the observations:

TABLE NO. 3

Means of Transportation	Shipments Inspected		Shipments Containing Ribes		Violations	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
Parcel Post	34,692	78.3	146	78.9	39	71.8
Express	9,112	20.5	37	20.0	16	28.2
Freight	510	1.2	2	1.1	0	0.0
Total	44,314	100.00	185	100.00	55	100.0

This table indicates that according to the number of shipments examined the proportionate number of violations is found no matter which means of transportation is used. In other words, the means of transportation which offers an opportunity to inspect the most packages will give the greatest number of violations. The conclusion is that parcel post offers the best opportunity for inspection because it offers the greatest number of packages which can be more easily concentrated and inspected. In other words, an inspector, since he can inspect parcel post much more readily and rapidly, can do the most effective work in the least amount of time in inspecting parcel post in preference to other types of shipments. Therefore the conclusion is drawn that if the Federal inspection is to be only a sampling process and not complete inspection, the importance of any inspection point should be determined according to the amount of parcel post it is possible to inspect at that point.

5. Period of Inspection

Due to the milder climate of the coast region nursery stock moves consistently from September until May. In order to get some index to the amount of this shipping, the Federal inspector was kept at Seattle from October 1, 1927, to May 1, 1928. The following table gives a summary of the observations at this point for seven month period.

TABLE NO. 4

RESULTS OF CONTINUOUS INSPECTION DURING WINTER AT SEATTLE, WN.

Month	Number of Shipments Observed			Ribes or Pine Shipments	
	Parcel Post	Express	Freight	Parcel Post	Express
October	1,843	272		4	0
Nov.	3,268	1,858		18	1
Dec.	1,619	311		4	0
Jan.	501	176		1	1
Feb.	2,216	671		11	2
Mar.	5,820	842		7	4
Apr.	5,287	609		21	1
Total	20,554	4,739		66	9

This data indicates that probably inspection should be continued at all coast points throughout the winter.

6. State of Washington Quarantines

Due to the amendment to the plant quarantine act the blister rust quarantines of the State of Washington become null and void. When this state reissued its state quarantines no blister rust quarantines were established.

However, Mr. Marble, Inspector at Large, and in charge of nursery inspection, issued an order on March 21 instructing his inspectors not to allow the intrastate movement of any currants or gooseberries which were not dormant or defoliated. A copy of this order accompanies this report. Apparently this order has no legal status, but it was vigorously enforced by state inspectors in all cases which have come to our attention. All of the State of Washington inspectors have cooperated with us to the fullest extent and as a result, very effective quarantine work is now established in Washington. If the present system in the State of Washington continues, shipments of blister rust host plants from Washington will be very much reduced. However, there is the very serious possibility that the state may lapse back to the old system after the next election.

Assistance has been given the state in the preparation of data for the establishment of a control area. A preliminary draft has been prepared and will probably be issued in the near future.

Some suggestions have been made that the original black currant order be reestablished and that the black currants on the coast region of Washington be eradicated. I cannot reconcile this recommendation with the purported object of the eradication of this plant. The primary object that has been set forth has been to hinder the disease in its long distance spread. The disease is now generally distributed over the State of Washington, hence this reason for eradication no longer exists. Furthermore, the black currant, especially on the coast region of Washington, represents considerable in the way of an industry, while neither state, Federal or private interests consider the white pine of the coast region of Washington of enough importance to consider its protection.

In order to show the importance of the black currant on the coast region of Washington the following data was compiled from the survey of the state which was made by this office:

1. The coastal region is 1/3 of the area of the state.
2. The coastal region has 82% of all black currant plantings.
3. The coastal region has 92% of all bushes.
4. The plantings in the coastal region average 13 bushes per planting, while those in the inland regions average only 5 bushes, thus indicating that many of the plantings in the coast region of Washington are of commercial importance.

Although apparently these bushes on the coast region were eradicated in 1922, yet it is reported by several observers that as many black currants still exist, if not more, than these observations indicate. Importation and plantings has continued. The state inspectors have not taken any steps to prevent this.

The only logical conclusion to be drawn from the facts is that the black currant industry is much more important on the coast region of Washington than the white pine industry. Further, foresters give no importance to white pine for this region while the berry interests do give considerable value to the black currant industry. Figuring that on the average, the bushes themselves are worth one dollar each, an initial capital investment of over $50,000 is represented by this industry. It is a very conservative estimate that these bushes will produce fruit each year worth one dollar per bush or an annual income of $50,000. Further considering this industry for 100 years, or the rotation for white pine, the revenue from this industry would represent $5,000.000.

For these reasons it appears that, first there is now no logical reason for eradicating the black currant on the coast region of Washington and second, such eradication would destroy an industry of considerable nature and third, the white pine is of no importance on the coast region of Washington.

For these reasons it appears that the only purpose of any quarantine affecting this region would be the restriction of the movement of these plants from the coastal region across the mountain to other parts of Washington, and I recommend that this section be suggested as the desirable one for the purpose of blister rust control.

CIRCULAR LETTER

No. 12

FLOWERING CURRANTS

To District Horticultural Inspectors:

Your attention is called to Federal quarantine #63 (Regulation 1, paragraph (c) and (e) and Regulation 4.) Although we have notState quarantine written at this time, no currant or gooseberry plants or cuttings shall be moved intra-state unless dormant and defoliated.

The Flowering Currants are now coming into bloom and all shipments, of plants or parts thereof, inter- or intra-state must be condemned.

Shippers of cut flowers and postal and express clerks, altho acquainted with this quarantine, should be warned again.

Very truly,

(s) Ralph S. Marble

Ralph S. Marble
Inspector at Large
Sumner, Washington

March 21, 1928

7. The blister rust situation in Oregon.

During March and part of April, one man was detailed to make a thorough investigation of the Oregon blister rust quarantine situation. The writer also spent about two weeks on this investigation and outlined and directed the investigation.

The investigation covered the infected and bordering counties. The following is a summary of conditions and conclusions based on this investigation. A considerable volume of facts have been collected but due to the size of the compilation it is not included.

1. No effort is being made to enforce the state blister rust quarantine.
2. No inspection is made of shipments either going out of the state or arriving at destination points which bear an Oregon inspection tag. Most violations of Quarantine 63 and the state quarantine which were intercepted by Federal inspectors, had state inspection certificates.
3. The special blister rust inspection tag called for under Quarantine 5 of State of Oregon is not being used or in other words, nurseries in Oregon shipping intrastate are not taking cognizance of State Quarantine 5. Only three nurseries in Oregon have taken any notice of the state quarantine and have used a few typewritten tags.
4. No effort is being made by State of Oregon to put the provisions of this quarantine into effect.
5. Terminal inspection is not being carried out.
   - A. State inspectors do not cooperate locally. Most of the inspectors are county agents who can give little time to this work.
   - B. Postmasters are not informed where to get material inspected and receive very little cooperation.
   - C. Some terminal inspection points are without state inspectors.
   - D. Over most of the territory there is no inspection at destination if the shipment has any sort of an inspection tag.
6. There is a great deal of movement of nursery stock by trucks in the Willamette Valley and along the Columbia Highway which it is difficult to control, and no effort is being made to control it.
7. A large percentage of the currants and gooseberries are contract grown. The state has no control over nor does it take cognizance of this condition.
8. The state is accepting the Federal permit for intrastate shipments. This is a misuse of the Federal permit.
9. The Columbia Highway and roads across Columbia are a constant means of violation. Oregon has discontinued any enforcement at these points.
10. Under the present system in Oregon, no improvement can be expected since there is no one who directs or manages what little system there is, or who will take the responsibility of improving the system.

Recommendations

1. Cooperation. Effective July first when the inspection work is transferred to the Federal Board organization, the present cooperative agreement for quarantine work will end. At that time the matter of cooperative quarantine work will be an agreement between Oregon State Board of Horticulture and the Federal Horticultural Board and the whole question will be open for rearrangement. At that time the actual conditions in Oregon should be taken into consideration. This agreement must be specific since the present general agreement is not satisfactory from a quarantine viewpoint.

2. Policy. (A) Since the amendment to the plant quarantine act limits the action which a state may take to protect itself, it now devolves upon the Federal Horticultural Board to guarantee to the several states any quarantine action which it may take. If it is not ready to do this in every case where the matter of the establishment of a Federal quarantine is under consideration, it should take no action, thus leaving those states which may so desire, free to protect themselves.

(B) Whenever the Federal Horticultural Board enters into an agreement with a state and as a result quarantines only part of a state, it by that very act, must guarantee to the other states the effectiveness of the state inspection system of that state and by means of money and men make said state inspection system effective if it is not already. effectiv

3. Change in quarantine. The situation in Oregon demands a definite stand and establishment of a policy. The situation is such, due to the type of organization or lack of organization of the State of Oregon, as well as the general geographical condition, that I do not believe that an effort should be made to guarantee the state system. The only logical action which the Board can take is to quarantine the entire State of Oregon and thus allow nothing to be moved out of the state without a Federal permit. Further, the inspection of the nurseries which request Federal permits should be made by a Federal man.

Some objection may be raised to quarantining the entire State of Oregon to the effect that this will allow the transportation of blister rust host plants over all of Oregon and thus bring the disease nearer to Idaho and California. However, that is, for all practical purposes, the present situation, since, in spite of the fact, that Oregon has passed a state quarantine no special effort is being made to enforce it. Since this is true and the Federal quarantine applies only to certain counties and allows blister rust host plants to be shipped out of the remainder of the state, there is a real danger present to other states. Further, if the State of Oregon is sincere in its belief that it desires to protect its own white and sugar pines, it will continue its present quarantine. At present it has the quarantine, but it is not even moderately effective. Due to the nature of

the organization, as well as its financial condition, very little improvement can be expected even with encouragement by the Federal Horticultural Board.

4. Quarantine enforcement. Federal inspectors at Portland and Pendleton, Oregon and Spokane, Washington, during the shipping season can control the shipments moving north and east. California inspectors can take care of the southern movement into that state. Hence, most violations out of the state can be intercepted.

INVESTIGATIVE WORK IN THE DEVELOPMENT OF CHEMICALS TOXIC TO RIBES

By

H. R. Offord, Agent

I. Introduction

In the Idaho white pine region, the Ribes species most susceptible to blister rust occur in great profusion in that portion of the forested area which is represented by a narrow strip or belt along the streams. The Ribes which occur in this so-called "stream type" are *Ribes petiolare, Grossularia inermis* and *R. lacustre.* The extreme susceptibility of *R. petiolare* and *G. inermis,* and their location at the base of forested slopes in moist situations, make them extremely dangerous factors in the spread of the rust. Economical eradication of *G. inermis* and *R. petiolare,* therefore, is vital to the success of the western control program. But because of the heavy concentrations of these Ribes and their occurrence in swampy places where considerable layering takes place, successful removal by hand pulling is expensive, if not impossible. Some years ago the Bureau of Plant Industry recognized the need of a method which would be cheaper and more effective than hand pulling, and in 1924 experiments on the chemical eradication of Ribes were started in the Far West. Experiments were carried out in 1924 by W. F. Huppke at Wallace, Idaho, and at Berkeley, California. They were continued over the period 1925-1927 by the writer, at Wallace, Santa, Clarkia and Bovill, Idaho; at Leland Meadow, Stanislaus National Forest, California, during 1927 and 1928; and at Still Creek, Oregon, in 1928. Research work has been in progress at the University of California during the winters of 1926-28.

II. Summary of Chemical Eradication Field Experiments 1924 - 1928

Experimental work performed by W. F. Huppke in 1924 tested out thirty-five chemicals as Ribicides. This work was checked over in June of 1925 by Huppke and the writer, and chemicals which showed promise were retested over permanent experimental plots in 1925. Three 1-acre plots at Wallace, Idaho, and five 1-acre plots at Santa, Idaho, were established in 1925. Chemicals were applied (1) as spray, (2) in solid form about the roots and crown, and (3) in saturated solution squirted on the soil at the base of the plant. Twenty-six chemicals were tested as Ribicides in the aforementioned manner. A three-gallon hand sprayer of the compressed air type was found to be satisfactory for the open type of country encountered. During the season of 1926 data were carefully taken over all plots. Sodium chlorate experiments were repeated, and a large scale test of the chemical was made in the light of the very favorable results shown by the 1925 work. Eight new Ribicides were tested on an additional 1-acre plot at Santa, Idaho, and fifteen acres of *R. petiolare* and *G. inermis* were eradicated by means of sodium chlorate. This latter work was done at Clarkia, Idaho, and special studies were made of equipment and crew working methods. A four-gallon knapsack sprayer was found to be most favorable. Seventy-three new spray formulae were tested out on Ribes at Santa, Idaho, in 1927. The

same year, some thirty acres of stream type Ribes were eradicated at Bovill, Idaho, and methods devised for using portable power sprayers. In the Stanislaus National Forest, California, some early season spraying was done on R. nevadense. Later in the season three 1-acre plots were established at Leland Meadow, Stanislaus National Forest and chemicals which had shown the greatest promise in Idaho were given preliminary testing. In 1928, three new 1-acre plots were established at Santa, Idaho, and ninety-nine Ribicides were tested out, chiefly on G. inermis and R. lacustre. Considerable experimental work was also done over areas on the South Fork of the Stanislaus River, and at Leland Meadow, Stanislaus National Forest, California. Some seventy-five spray formulae were tested over these permanent experimental plots in California. Experimental work was commenced at Still Creek, Oregon, and eighteen sprays were applied to R. bracteosum and R. lacustre.

III. Summary of Research Work Carried Out at Berkeley, During the Winter 1927-28

In presenting a summary of the research work, it is intended that reference to the writer's original research reports should be made for complete information. In this paper only the facts immediately pertinent to the organization of field experiments are given.

Experiments on several Ribes species have shown that sodium chlorate is rapidly and evenly distributed throughout the tissue if cut stems are placed in the salt solution. The same holds true if dilute chlorate solutions are added to sand or water cultures on which vigorous and healthy Ribes are growing. When the chemical is sprayed on the aerial parts, however, differences in susceptibility are invariably shown by the several Ribes species.

These data indicate that differences may be due to (1) protective tissues which prevent the chlorate from entering vital groups of cells, (2) plant buffers which are capable of rendering the sodium chlorate inactive, and (3) structural differences which allow extensive movement of the chlorate in the case of one species, and keep the chemical effects rather localized in others.

Qualitative chemical analysis of leaves and stems of four Ribes species suggests significant differences in the suberin-cutin and lignin fractions. It was also noted that R. petiolare (most susceptible to sodium chlorate) contained 2 - 4% tannin, while R. lacustre (very resistant to sodium chlorate) contained 8 - 12%. The most significant data obtained from early investigations of the tannin content of the various Ribes species are the different reactions of the tannins themselves. The tannins differ markedly in their ability to precipitate other chemicals and suggest a specific buffer effect.

W. 446. Complete kill on G. inermis with $NaClO_3$, 25%; NaOH, 2%. Santa, Idaho.

W. 449. G. inermis sprayed 1927, showing suckering from crown. Sprayed with $NaClO_3$, 25%; CH_3COOH, 1%. Santa, Idaho.

Fundamental studies on the nature of the toxic action of sodium chlorate were made. Nitella was used as the plant material. The results pertinent to these studies are as follows:

1. No physiological "accumulation" of the chlorate ion, as such, occurs within the protoplast.

2. The initial toxic action of the sodium chlorate is confined to the cell wall and possibly the plasma membrane. After the cell wall or plasma membrane has been injured, it then becomes permeable and sodium chlorate is able to diosmose into the protoplast.

3. Both wave length and intensity of light are important governing factors; the latter is probably the more important of the two. The penetration of the chlorate into the protoplast, even after the cell wall has been injured, is considerably curtailed in the absence of light.

4. Sodium chlorate penetrates more rapidly in a pH medium of 5 than in a medium having a pH of 7.

5. Ammonium chloride and ammonium sulphate, on the other hand, "accumulate" within the cell sap.

6. Mixtures of sodium chlorate and calcium chloride are less toxic than sodium chlorate alone. Apparently calcium salts exhibit the well-known protective role when added to the chlorate solutions.

7. Addition of ammonium chloride to sodium chlorate provides a more toxic medium than the sodium chlorate alone, and considerably more than the calcium chloride-sodium chlorate mixture.

IV. Field Experiments Suggested by Research Work

Research work suggested that only a small amount of the chlorate which was sprayed on the plant was needed to accomplish death of the protoplasm. The observation that the chlorate penetrated faster in a pH of 5 than in a pH of 7, indicated that a substantial reduction of the toxic concentration of the chlorate spray might be effected by making use of sprays buffered to a definite pH. The idea of combining two types of toxic agents such as ammonium chloride and sodium chlorate was also suggested. A large number of possible combinations of sprays immediately presented themselves for consideration. The protective nature of the suberin-cutin fractions, and the fact that they existed in different amounts, suggested the addition of a caustic agent or an active oxidizer to the passive chlorate spray. The efficiency of the chlorate when made available to the xylem was particularly interesting, and spray formulae were considered containing ingredients which would assist the chlorate in penetration of the outer tissues. The observed diminution of the

starch content following application of the sodium chlorate indicated that a product of hydrolysis of the starch molecule might be functioning as a toxin, and that a small amount of the secondary compound would do the work of the initial large amount of the chlorate. Several of these compounds were selected for field tests. Some ninety spray formulae were chosen in the light of the above work.

V. Experimental Work in Idaho

1. Recheck of 1927 Spraying

Experimental plots established at Santa in 1927 were carefully checked over and data taken early in June by Ganoung, Haring and the writer. Percentage of kill on live stem and percentage of bushes completely killed were computed according to the methods used in previous years. Results of the recheck are given in Table 1.

The area at Clarkia, Idaho, which had been sprayed in 1926 with sodium chlorate was checked. No *R. petiolare* sprouts of 1927 origin were found. *G. inermis* and *R. lacustre* which had been partially killed by the 1926 application showed vigorous and healthy growth. The 1927 area at Bovill was checked by strip method with a crew of three men. Data are given in Tables 2-a to 2-d, for each type of spray applied.

TABLE NO. 1

RESULTS OF 1927 EXPERIMENTAL SPRAYING AT SANTA, IDAHO
DETERMINED BY 1928 CHECK.

Date of Application	Plot Number	Chemical Used and Concentration	How Applied	Gallons Used	Number Bushes Treated		Per Cent Live Stem Killed		Per Cent Bushes Killed	
					R. lacustre	G. inermis	R. lacustre	G. inermis	R. lacustre	G. inermis
July 2 & 7	IIIA (2-3)	Leaves stripped by hand.	Third time		2	268	98.6	44.2	50.0	2.6
" 5	IIA (2-3)	$KClO_3$ - 5% + NH_4NO_3 - 10%	Spray	14	1	370	33.3	38.4	0.0	1.6
" 6	IIB (2-3)	$KClO_3$ - 5% + CH_3COOH - 1%	"	12	1	226	23.1	34.6	0.0	1.8
" 7	IA (1-2)	NaOH - 4%	Re-spray	16	64	248	75.5	56.1	10.9	12.2
" 8	IA (6-6.5)	$NaClO_3$ - 25% + CH_3COOH - 1%	Spray	10	3	130	100.0	89.5	100.0	38.5
" 9	IA (5-6)	$NaClO_3$ - 25% + NaOH - 2%	"	13	33	162	99.7	97.7	84.9	79.0
" 11	IIA (0-1)	$NaClO_3$ - 25% + HCl - 1%	"	8	1	162	100.0	92.6	100.0	49.4
" 14	IIA (3-4)	$Al_2(SO_4)_3$ - 25%	"	9	1	132	66.7	26.2	0.0	0.8
" 14	IIA (3-4)	K_2SO_4- Saturated Solution	"	2	-	35	-	32.2	-	0.0
" 15	IIIA (5-6)	$(NH_4)_2S_2O_8$ - 25%	"	3	-	36	-	52.6	-	5.5
" 15	IIIA (5-6)	$(NH_4)_2S_2O_8$ - 15%	"	3	-	25	-	31.1	-	4.0
" 16	IIIA (6-6.6)	$Al_2(SO_4)_3$ - 20%	"	3	-	[illegible]	-	22.0	-	0.0
" 16	IIA (6-6.6)	$KMnO_4$ - 15% + HCl - 3%	"	2	1	74	25.0	13.4	0.0	0.0
" 18	IIIA (4-5)	$Na_2Cr_2O_7$ - 50%	"	1½	-	25	-	53.3	-	4.0
" 18	IIIA (4-5)	$Na_2Cr_2O_7$ - 25%	"	2	-	43	-	44.9	-	4.6
" 19	IIIA (4-5) IIIB (4-5)	HCl - 3% + $KMnO_4$ - Sat.	"	6	7	75	54.6	16.8	0.0	0.0
" 19	IIIB (3-4)	$KMnO_4$- Sat.	Crown App.	4	-	52	-	16.8	-	3.8
" 19	IIIB (3-4)	K_2SO_4 - Sat.	" "	12	-	47	-	16.7	-	0.0
" 21	IVA (0-1)	$HClO_3$ - 4%	Spray	4	1	49	46.7	20.4	0.0	2.0
" 22	IVA (2.0-2.35)	CH_3COOH - 8%	"	5	-	69	-	20.0	-	0.0
" 22	IVA (2.35-2.5)	CH_3COOH - 12%	"	1	-	38	-	17.2	-	0.0
" 23	IVB (0.0-0.3)	CS_2 - 100%	Crown App.	[illegible]	1	26	16.0	30.4	0.0	0.0
" 23	IVB (0.3-1.0)	NaOH - 2% + CS_2 - 100%	" "	[illegible]	2	40	45.5	15.8	0.0	0.0
" 23	IVA (2.5-2.7)	$NaClO_3$ - 25% + HCl - 2%	Spray	1	-	16	-	60.4	-	18.7
" 26	IVA (2.7-3.0)	Na_2SO_3 - 20%	"	5	1	45	100.0	19.8	100.0	0.0
" 26	IVA (3-4)	Na_2SO_3 - 15%	"	8	-	89	-	17.7	-	0.0
" 27	IVA (4-5)	Na_2SO_3 - 15% + Ca.Caseinate - 2%	"	6	1	56	25.0	22.7	0.0	0.0
" 27	IVA (5-6)	$KClO_3$ - 4% + Glycerine - 1%	"	6	1	87	16.7	29.0	0.0	2.3
" 28-29	IVA (6-6.6)	Na_2SO_3 - 15%	Crown App.	6	5	81	37.5	21.6	0.0	3.7
Aug. 4-5	VA (0-1)	$NaClO_3$ - 25% + NH_4Cl - 20%	Spray	12	6	106	94.5	71.5	66.7	37.8
" 5	IIB (0-.5)	$NaClO_3$ - 25%	"	11	12	125	78.3	71.0	50.0	22.4
" 6	IIB (.5-1)	$NaClO_3$ - 25% + Glue 0.1%	"	12	-	192	-	57.2	-	8.3
" 6-8	IIB (1-1.5)	$NaClO_3$ - 25% + Fish Oil Soap - 1.0%	"	7	1	159	100.0	56.6	100.0	5.7
" 8	IIB (1.5-2)	$NaClO_3$ - 25% + Ca.Caseinate - 2%	"	7	-	74	-	77.3	-	25.7
" 9	VA (1-1.7)	NH_4Cl - 30%	"	8	5	67	60.0	56.8	40.0	12.0
" 10	VA (2-3)	$KClO_3$ - 4% + NH_4Cl - 10%	"	11	-	67	-	37.0	-	10.5
" 11	VA (3-3.7)	$KClO_3$ - 4% + NH_4Cl - 5%	"	10	2	52	51.1	30.2	0.0	1.9
" 13	VA (4-4.5)	$NaClO_3$ - 25% + $MnCl_2$ - 0.1%	"	6	-	39	-	56.7	-	18.0
" 13	VA (4.5-5)	$NaClO_3$- 25% + $MnCl_2$ - 0.2%	"	6	-	39	-	71.3	-	41.0
" 15	VA (5-5.5)	$NaClO_3$ - 25% + $MnCl_2$ - 0.5%	"	6	1	25	100.0	79.4	100.0	16.0
" 16	VA (5.5-6)	$NaClO_3$ - 25% + $MnCl_2$ - 1%	"	5	-	28	-	77.4	-	46.5
" 16	VA (6-6.6)	$NaClO_3$ - 25% + $MnCl_2$ - 2%	"	7	3	70	80.3	33.3	68.2	21.4
" 16 & 17	VB (2-2.5)	$NaClO_3$ - 25% + NH_4Cl - 20% + Glycerine -.5%	"	9	-	81	-	70.9	-	32.1
" 17	VB (2.5-3)	$NaClO_3$ - 25% + NH_4Cl - 20% + Glycerine - 1%	"	7½	-	45	-	66.6	-	44.4
" 18	VA (1.7-2)	$NaClO_3$ - 25% + HCl - 1%	"	3	-	18	-	86.8	-	61.1
" 18	VA (3.7-4)	$NaClO_3$ - 25% + HCl - .5%	"	3½	-	10	-	69.6	-	20.0
" 19	VB (3.5-4)	$NaClO_3$ - 25% + NH_4Cl - 20%	"	16	-	36	-	86.6	-	50.0
" 19 & 20	VB (4-4.5)	$NaClO_3$ - 50%	"	6	-	17	-	92.4	-	68.4
" 20	VB (4.5-5)	$ZnCl_2$ - 25%	"	4	-	20	-	66.0	-	20.0
" 20	VB (5-5.5)	$NaClO_3$ - 25% + $ZnCl_2$ - 15%	"	2	-	22	-	44.1	-	4.5
" 22	VB (5.5-6)	$KClO_3$ - 5% + $ZnCl_2$ - 25%	"	4	-	25	-	59.9	-	16.0
" 23	IVB (2-2.2)	$CH_3C_6H_4OH$ - 1.5%	"	6	-	44	-	40.1	-	4.5
" 24	IVB (2.2-2.4)	$CH_3C_6H_4OH$ - 2.5%	"	5	-	50	-	34.3	-	6.0
" 24	IVB (3-3.5)	$C_6H_4Cl_2$ - 1%	"	6	-	33	-	21.4	-	0.0
" 25	IVB (2.4-2.65)	$CH_3C_6H_4OH$ - 10%	Suspension Crown App.	5	-	31	-	59.5	-	29.0
" 25	IVB (3.5-4)	$C_6H_4Cl_2$ - Sat.	Crown App.	4	-	24	-	61.0	-	8.3
" 24	VB (6-6.6)	K_2SO_4 - Dry	" "	6¼	-	26	-	48.4	-	11.5
" 26	IVB (2.65-3)	$C_6H_4Cl_2$ - Dry	" "	12¼	-	21	-	59.2	-	28.8
" 26	IVB (6-6.1)	$C_6H_4Cl_2$ - Dry	" "	6¼	-	13	-	36.9	-	30.8
" 26	IVB (6.1-6.5)	NH_4Cl - 25%	Spray	3	-	46	-	47.2	-	19.6
" 26	IVB (6.5-6.6)	$C_6H_4Cl_2$ - Sat.	"	2	-	21	-	20.1	-	0.0
July 1	IB (0-1)	$NaClO_3$ - 25%	3 Re-spray	2	38	106	99.4	99.4	81.5	89.5
" 22	IVA (1-2)	HCl - 4%	Spray	4	-	54	-	18.6	-	0.0
" 19	IIIB (3-4)	Soil Protected by Tar Paper. $NaClO_3$ - 25%	"	4	-	10	-	94.0	-	50.0

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1928 Recheck of 1927 Bovill Plots

TABLE NO. 2a

Spray #1 - $NaClO_3$ - 25%. Applied July 1 to July 15.

	G. inermis	R. lacustre	R. petiolare
Number of Bushes Measured	388	88	-
Live Stem Growth During 1928	1,331	82	-
Live Stem at End of 1927 Season	438	16	-
Dead Stem, 1928	5,812	1,262	-
% Kill on Basis 1928 Live Stem	76.8	92.8	99+
% Kill on Basis 1927 Live Stem	93.0	98.9	99+
% Kill - Root Systems	31.8	59.1	99+

Area of Strips Run in Course of Data Taking = .469 acres
Area Sprayed with Solution #1 = 9.16 acres

TABLE NO. 2b

Spray #2 - $NaClO_3$ - 25% + Fish Oil Soap. Applied July 10 to July 30.

	G. inermis	R. lacustre	R. petiolare
Number of Bushes Measured	83	22	-
Live Stem Growth During 1928	651	39	-
Live Stem At End of 1927 Season	400	42	-
Dead Stem, 1928	658	298	-
% Kill on Basis 1928 Live Stem	38.6	78.6	99+
% Kill on Basis 1927 Live Stem	62.3	87.6	99+
% Kill - Root Systems	1.2	13.6	99+

Area of Strips Run in Course of Data Taking = .134 acres
Area Sprayed with Solution #2 = 6.11 acres

TABLE NO. 2c

Spray #3 - $NaClO_3$ - 25% + Glue. Applied July 15 to July 30

	G. inermis	R. lacustre	R. petiolare
Number of Bushes Measured	49	12	-
Live Stem Growth During 1928	516	19	-
Live Stem at End of 1927 Season	224	29	-
Dead Stem 1928	565	356	-
% Kill on Basis 1928 Live Stem	43.3	88.2	99+
% Kill on Basis 1927 Live Stem	71.7	92.5	99+
% Kill - Root Systems	-	41.6	99+

Area of Strips Run in Course of Data Taking = .135 acres
Area Sprayed with Solution #3 = 5.44 acres

TABLE NO. 2d

Spray #4 - $NaClO_3$ - 20% Applied August 1 to August 7.

	G. inermis	R. lacustre	R. petiolare
Number of Bushes Measured	178	43	-
Live Stem Growth During 1928	1,183	84	-
Live Stem at End of 1927 Season	694	72	-
Dead Stem 1928	1,818	383	-
% Kill on Basis 1928 Live Stem	49.2	71.1	99+
% Kill on Basis 1927 Live Stem	72.3	84.2	99+
% Kill - Root Systems	5.6	18.6	99+

Area of Strips Run in Course of Data Taking = .331 acres
Area Sprayed with Solution #4 = 6.88 acres

W. 445. Showing chemical on Ribes leaves 2 hours after spraying with $NaClO_3$. 20%; NH_4Cl, 2%. Santa, Idaho.

W. 448. G. inermis sprayed with different chemical solutions. Bush on right (behind hand axe) $NaClO_3$, 30%; $KMnO_4$, 2%. Bush on left $NaClO_3$, 30%; pH 12. Santa, Idaho.

2. Experimental Work for 1928.

Three new 1-acre plots, (VII, VIII and IX) were located. Two of these plots, VIII and IX, were located on the old area at Santa and contained G. inermis and R. lacustre. Plot VII was located in a burned cut-over, about 1 mile north of Santa on the Coeur d'Alene logging road. R. viscosissimum occurred in very heavy concentration on this plot. Nineteen experimental areas were located along Renfrow Creek where R. petiolare was found, and a number of dilute acid and alkaline chlorate sprays were tested over these stations. It was decided to save time by taking Ribes data over the new areas the spring following application, and also to obtain a comparison with the former method of taking data before spraying. Experimental tests were conducted over these plots from June 7 to September 1.

Table No. 3 gives a summary of the experimental spraying performed at Santa, Idaho during the field season 1928. Weather data are given in Table No. 4 for the Santa area over the same period. In Table No. 5 the data on large scale experiments with acid and alkaline chlorate sprays are given. These experiments were performed by P. B. Bell with the assistance of the Bovill chemical eradication crews, and intended to test over a large area the earlier plot experiments which showed that alkaline chlorate sprays produced the best results on G. inermis and that acid sprays were most effective on R. petiolare.

TABLE NO. 3

SUMMARY OF EXPERIMENTAL SPRAYING DONE AT SANTA, IDAHO, 1928

Date of Application	Plot Number	Chemical Used	Concentration Percentage By Weight	How Applied	Gallons Used
June 7	VI A (5-5.7)	$NaClO_3$	25	Spray	10
" 9	VI [illegible] (5.7-6)	$NaClO_3$	30	"	5
" 9	VI B (5-5.4)	$NaClO_3$ $CaCl_2$	30 22.5	"	[illegible]
" [illegible]	VI B (5.4-5.7)	$NaClO_3$ [illegible]	25 20	"	[illegible]
" 14	VI B (5.7-6)	[illegible] [illegible]	20 15	"	[illegible]
" 14	VI A (6-6.6)	$NaClO_3$ $NaOH$	30 1	"	15
" 16	VI B (6-6.6)	$NaOCl$	[illegible]	"	9
" 16	G. inermis Opposite VI B	$NaOCl$	Sat.	Crown App.	[illegible]
" 18	VI A (4-4.4)	$NaClO_3$ $MnCl_2$	30 0.1	Spray	[illegible]
" 26	VI A (4.4-5)	$NaOCl$	Sat. Solution Diluted Once	"	6
" 26	VI B (4-5)	$NaClO_3$ $NaOCl$	15 14	"	10
" 26	R. petiolare X-1	$NaClO_3$	10	"	2
" 26	I A (0-.5)	$NaClO_3$ $NaOCl$	20 20	"	10.5
" 26	I A (.5-.95)	$NaClO_3$ $NaOCl$	20 53	"	7.5
" 27	I A (2-2.7)	$NaClO_3$ Furfural	20 5	"	13
" 27	VII A (0-.65)	$NaClO_3$	20	"	9
" 28	VII A (.65-1)	$NaClO_3$	25	"	4.5
July 9	I A (4-5)	$NaClO_3$ $NaOH$	25 2	"	14
" 10	[illegible]	$NaClO_3$ $NaOH$	20 2	"	10
" 10	I A (2.7-3)	$NaClO_3$ Furfural	20 2	"	[illegible]
" 11	I B (2-3)	$NaClO_3$ Furfural	20 1	"	18
" [illegible]	VI A (2-2.4)	$NaClO_3$ $NaOH$	20 4	"	[illegible]
" [illegible]	VI[illegible] A ([illegible]-1.4)	Na[illegible]	30	"	[illegible]
" [illegible]	VI[illegible] A (1.4-2)	$NaClO_3$	15	"	[illegible]
" 16	VI[illegible] [illegible] (2-3)	$NaClO_3$ $CaCl_2$	25 10	"	5.5
" [illegible]	VII B (0-1)	$NaClO_3$ $CaCl_2$	25 13	"	[illegible]
" 17	VI A (2.4-3)	$NaClO_3$ $MnCl_2$	30 0.2	"	[illegible]
" 17	VI A (3-3.65)	$NaClO_3$ $MnCl_2$	30 1.0	"	[illegible]
" 18	[illegible]	$NaClO_3$ $FeCl_3$	30 0.[illegible]	"	5.5
" 21	VII [illegible] (3-4)	$NaClO_3$ $CaCl_2$	25 20	"	6.5
" 21	VII B (1-1.45)	$NaClO_3$ NH_4Cl	25 1[illegible]	"	[illegible]
" 21	I B (5-5.5)	$NaClO_3$ $FeCl_3$	30 0.2	"	[illegible]
" [illegible]	VII B (1.45-2)	$NaClO_3$ NH_4Cl	25 12.5	"	[illegible]
" 23	I B (5.5-6)	$NaClO_3$ $FeCl_3$	30 1.0	"	10
" 24, 25	I B (6-6.6)	$NaClO_3$ $Na_2Cr_2O_7$	15 5	"	10
" 25	II A (5-6)	$NaClO_3$ $Na_2Cr_2O_7$	20 5	"	7.5
" 25	II A (6-6.6)	$NaClO_3$ $Na_2Cr_2O_7$	30 2	"	5
" 26	II B (3-4)	$NaClO_3$ $KMnO_4$	15 5	"	[illegible]
" 27	II A (3-4)	$NaClO_3$ $KMnO_4$	20 5	"	7
" 28	VII B (2-2.4)	$NaClO_3$ pH = 2	25	"	[illegible]
" 28	VII B (2.4-3)	$NaClO_3$ NH_4Cl	25 15	"	[illegible]
" 28	VII B (3-3.4)	$NaClO_3$ pH = [illegible]	25	"	[illegible]
" [illegible]	III A (0-.5)	$NaClO_3$ Furfural	15 1	"	10
[illegible]gust 1	III A (.5-1)	$NaClO_3$ Furfural	15 2	"	12
" [illegible]	III B (5-6)	$NaClO_3$ $KMnO_4$	30 2	"	[illegible]
" [illegible]	III [illegible] (1-1.5)	$NaClO_3$ Furfural	15 5	"	[illegible]
" [illegible]	III [illegible] (1.5-2)	$NaClO_3$ C_6H_5OH	20 0.1	"	5.5

Date of Application	Plot Number	Chemical Used	Concentration Percentage By Weight	How Applied	Gallons Used
August 4	III [illegible] (0-1)	$NaClO_3$ C_6H_5OH	30 0.1	Spray	[illegible]
" [illegible]	IV A (3-4)	$NaClO_3$ $Na_2B_4O_7$	15 5	"	5.5
" [illegible]	IV A (2-3)	$NaClO_3$ $Na_2B_4O_7$	25 5	"	7
" [illegible]	III B (1-1.3)	$NaClO_3$ $Na_2B_4O_7$	30 2	"	[illegible]
" [illegible]	II[illegible] B (1.3-2)	Furfural	5	"	7.5
" 7	X-2 R. petiolare	$NaClO_3$ pH 7	15	"	[illegible]
" 7	X-3 R. petiolare	$NaClO_3$ pH 7	20	"	[illegible]
" 7	X-4 R. petiolare	$NaClO_3$ $Na_2Cr_2O_7$	15 2	"	1.5
" [illegible]	X-5 R. petiolare	$NaClO_3$ $Na_2Cr_2O_7$	15 5	"	1.5
" 8	X-6 R. [illegible]	$NaClO_3$ $KMnO_4$	15 2	"	1.5
" [illegible]	X-7 R. petiolare	$NaClO_3$ [illegible]	15 5	"	2
" [illegible]	X-[illegible] R. [illegible]	$NaClO_3$ NH_4Cl	20 10	"	1.5
" 8	X-[illegible] R. [illegible]lare	$NaClO_3$ [illegible]	10 5	"	[illegible]
" [illegible]	[illegible]re	Furfural	[illegible]	"	[illegible]
" [illegible]	II A ([illegible])	C_6H_5OH	1	"	6
" 10	II B (2-3)	C_6H_5OH	5	"	5.5
" 14	VIII A (0-1)	$CaClO_3$ pH 7 $CaCl_2$	25 13	"	5.5
" 14	VIII A (1-2)	$NaClO_3$ pH 7 $CaCl_2$	25 10	"	7
" 14	VIII A (2-3)	$NaClO_3$ pH 7	20	"	5
" 15	VIII A (3-4)	$NaClO_3$ pH 7	15	"	5
" 16	X-11 R. petiolare	$NaClO_3$ pH 2	10	"	8
" 16	X-12 R. petiolare	$NaClO_3$ pH 12	10	"	7
" 16	X-13 G. irrigua	$NaClO_3$ pH 7	25	"	5
" 17	X-14 R. petiolare	[illegible]$aClO_3$ pH 7	7.5	"	3
" 17	X-15 R. petiolare	$NaClO_3$ pH 7	5	"	2
" 17	X-16 R. petiolare R. lacustre G. inermis	$KClO_3$ pH 2	Sat. 4.5	"	5
" 17	[illegible]-17 R. petiolare	$KClO_3$ pH 7	Sat. 4.5	"	4
" 18	[illegible] (4-5)	$NaClO_3$ pH 2	30	"	8
" 18	[illegible]-18 R. petiolare	$NaClO_3$ pH 2	20	"	1.5
" 20	VIII A (5-5.65)	$NaClO_3$ pH 12	30	"	5
" 20	VIII A (5.65-6)	$NaClO_3$ pH 2	20	"	4.5
" 20	[illegible] A (6-6.6)	$NaClO_3$ pH 12	20	"	6.5
" 22	VIII B (0-1)	$NaClO_3$ pH 2	15	"	6.5
" 22	V[illegible] B (1-1.4)	$NaClO_3$ pH 12	15	"	[illegible]
" 22	VIII B (1.4-2)	$NaClO_3$ pH 2 $CaCl_2$	25 10	"	[illegible]
" 23	VIII B (2-3)	$NaClO_3$ pH 12 $CaCl_2$	25 10	"	[illegible]
" 23	[illegible] B (3-4)	$NaClO_3$ pH 12 $CaCl_2$	25 20	"	6.5
" 23	VIII B (4-5)	$NaClO_3$ pH 2 $CaCl_2$	25 20	"	[illegible]
" 24	VIII B (5-6)	$NaClO_3$ pH 12 NH_4Cl	25 2	"	[illegible]
" 25	VI[illegible] B (6-6.6)	$NaClO_3$ pH 7 NH_4Cl	25 2	"	6.5
" 27	IX [illegible] (0-.4)	$NaClO_3$ pH 2 NH_4Cl	25 2	"	[illegible]
" 27	IX A (.4-1)	$NaClO_3$ pH 12 NH_4Cl	25 5	"	5.5
" 27	IX A (1-2)	$NaClO_3$ pH 7 NH_4Cl	25 5	"	[illegible]
" 28	IX [illegible] (2-3)	$NaClO_3$ pH 2 NH_4Cl	25 5	"	[illegible]
" 29	IX [illegible] ([illegible]-4)	$NaClO_3$ pH 2 NH_4Cl	25 10	"	[illegible]
" 29	IX B (0-.4)	$NaClO_3$ pH 7 NH_4Cl	25 10	"	[illegible]
" 29	IX B (.4-1)	$NaClO_3$ pH 12 NH_4Cl	25 10	"	[illegible]
" 30	IX B (1-2)	$NaClO_3$ pH 12 $CaCl_2$	25 13	"	6.5
" 30	IX B (2-3)	$NaClO_3$ pH 2 $CaCl_2$	25 13	"	[illegible]
" 31	V B (0-.95)	$NaClO_3$ $HClO_4$	25 1	"	4.5
" 31	V B (1-2)	$NaClO_3$ H_2SO_4	25 1	"	[illegible]
September 1	V-19 R. petiolare	$NaClO_3$ pH 2	15	"	[illegible]

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TABLE NO. 4

SOIL TEMPERATURE, RELATIVE HUMIDITY AND WEATHER LOG

SANTA, IDAHO. JUNE 7 - AUGUST 31, 1928.

Date	Soil Temperature			Relative Humidity			Weather
	7:30 AM	12 Noon	4:30 PM	7:30 AM	12 Noon	4:30 PM	
June 7	-	-	-	70	50	44	Cloudy and sunny at intervals. Windy.
" 9	-	-	-	60	47	40	Warm, bright sun.
" 13	48	-	-	60	41	42	Fine, warm, clear.
" 14	-	48	58	52	46	18	Fine, warm, cloudy in late afternoon.
" 15	52	55	56	69	36	48	Cool, cloudy.
" 16	42	50	54	63	56	53	Cool, cloudy, slight rain in A.M.
" 18	51	56	59	82	78	56	Cool, cloudy, westerly wind.
" 19	54	56	58	61	48	49	Warm, cloudy, slight rain in A.M.
" 20	54	56	59	51	60	48	Fair, warm, clear.
" 21	55	58	59	66	59	63	Warm, clear.
" 22	57	58	60	70	71	80	Cool, cloudy, intermittent rain all day.
" 23	57	58	61	85	47	55	Fair, warm, clear.
" 25	59	62	-	73	74	-	Hot, clear, bright sun.
" 26	58	59	61	65	57	49	Warm and cloudy.
" 27	58	59	-	66	48	-	A.M.-cool, breeze-P.M.-heavy rain 3:30 P.M.
" 28	56	59	61	83	62	68	A.M.-cool, cloudy-P.M.-sunny late P.M.
" 29	-	-	-	-	-	-	Cold, cloudy.
" 30	-	57	59	-	65	56	Cold, cloudy.
July 2	56	58	61	66	46	-	F-W-C Breeze.
" 3	57	58	60	84	95	79	Cl-Cy-Intermittent rain.
" 5	54	55	56	88	82	73	Cl-Cy-Rain in P.M.
" 6	to Bovill						Cl-Cy.
" 7	54	56	59	67	53	44	F-W-Cy.
" 9	55	58	60	51	50	40	F-W-C-Breeze.
" 10	52	57	60	58	51	41	F-W-C-Breeze.
" 11	54	56	61	60	41	42	F-W-C-Breeze.
" 12	56	58	62	48	60	60	F-W-C.
" 13	60	62	65	63	35	30	F-W-C-Breeze.
" 14	58	62	65	60	39	42	F-W-C.
" 16	61	63	65	80	46	38	F-W-C.
" 17	55	58	61	66	65	56	Warm-Cy-Rain in evening.
" 18	57	61	64	89	49	51	W-Cy-Rain in P.M.
" 19	56	60	-	88	94	68	Cl-Cy, Heavy rain at noon.
" 20	57	60	64	83	50	44	Warm-Cy.
" 21	55	63	66	70	38	34	F-W-C, Hot.
" 23	57	63	68	64	34	29	F-W-C, Hot.
" 24	58	66	71	59	29	29	F-W-C, Hot.
" 25	59	64	68	52	25	23	F-W-C-Breeze-Hot.
" 26	62	65	70	64	25	19	F-W-C--Hot.
" 27	63	67	71	-	-	-	Warm-Cloudy.
" 28	63	66	73	-	-	-	F-W-C.
" 30	-	-	-	-	-	-	F-W-C-Breeze.
" 31	54	58	-	-	-	-	F-W-C-Breeze.
Aug. 1	55	57	61	Not	Taken		Cool, cloudy.
" 2	53	58	62				Warm, cloudy.
" 3	52	58	63				F-W-C.
" 4	53	58	63				F-W-C, Breeze.
" 6	53	58	62				F-W-C, Breeze.
" 7	52	58	62				F-W-C, Breeze.
" 8	52	58	63				F-W-C.
" 9	53	59	65				F-W-C, Breeze.
" 10	53	60	66				Warm, cloudy, sultry.
" 11	57	60	63				A.M.-Cloudy P.M.-F-W-C.
" 13	53	56	60				Warm - Cloudy - Windy.
" 14	51	55	60				Warm, cloudy.
" 15	48	54	59				Warm, Cy. - First frost this A.M.
" 16	47	52	58				F-W-C.
" 17	47	53	-				F-W-C.
" 18	48	53	59				F-W-C.
" 20	47	52	58				F-W-C.
" 21	47	53	59				F-W-C.
" 22	49	55	59				Warm, Cloudy.
" 23	51	56	59	-	41	60	Warm, Cloudy.
" 24	-	53	59	-	56	34	Cool, Cloudy. Rain in A.M.
" 25	48	56	60	71	52	50	Cool, Cloudy. Rain in afternoon.
" 27	50	55	57	82	68	77	Cl-Cy-Windy-Occasional light showers.
" 28	49	52	56	100	55	39	A.M.-Heavy fog--P.M.-Warm, Cloudy.
" 29	45	50	56	67	40	34	F-W-C.
" 30	45	50	56	63	33	31	F-W-C.
" 31	46	52	57	69	50	26	F-W-C.

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TABLE NO. 5

LARGE SCALE APPLICATION OF ACID AND ALKALINE CHLORATE SPRAYS AT BOVILL, IDAHO 1928

Location	Man Spraying Days	Acres Sprayed	Spray Method Used	Chemical Used	Gallons Used
Sec. 33	4-1/4	1.50	Knapsack	X.1 $NaClO_3$ - 25% + NaOH - 2%	61.5
" 35	4-1/4	1.65	Power	X.2 $NaClO_3$ - 20% + NaOH - 1%	83.0
" 35	4	1.35	"	X.3 $NaClO_3$ - 15%	65.0
" 35	6-1/2	1.40	"	X.4 $NaClO_3$ - 10%	83.0
" 35	5-1/4	1.40	"	X.5 $NaClO_3$ - 10% pH = 2	103.0

VI. Experimental Work in California Stanislaus National Forest.

1. Recheck of 1927 Spraying.

Three Ribes species were treated with sodium chlorate - 25%, in July, 1927. The species treated were R. nevadense, G. roezli and R.cereum.

(1) R. nevadense. A large concentration along the flume of the P.G. & E. on the South Fork of the Stanislaus River was sprayed. Data taken in May, 1928, showed 36% of the bushes killed. Crown applications of sodium chlorate were nearly 100% effective. Sprayed bushes were sprouting rather weakly from the crown. At Leland Meadow, sodium chlorate killed 35% of the bushes on Plot 1 B (1-2) and 15% on 1 B (2-3).

(2) G. roezli. Treated with sodium chlorate - 25%, in 1927. Plots VI A (1-2) and VI (2-3) showed no complete kills, with 62% and 26% kill of live stem respectively.

(3) R. cereum. A 25% solution of chlorate was applied to four large bushes in 1927. A complete kill of the live stem was obtained in each case but this was followed by vigorous crown sprouting the following spring.

2. Experimental Work for 1928.

R. P. d'Urbal was in charge of the California work, and with the assistance of one man staked out a number of plots and took Ribes data over these plots according to the methods used in previous years. Plots were laid out in three areas on the South Fork of the Stanislaus River.

Area 1 was an 11-year-old cutover, and embraced a small stream on the south side of the river 2-1/2 miles downstream from Strawberry. Two plots, providing ample open type R. nevadense, were staked out in this area. Area 2 was adjacent to the railroad and 1/2 mile southwest of Area 1. Area 2 was a cutover section along the stream bottom and was quite open. R. nevadense occurred along the stream edge and G. roezli were found holding to the higher spots of this area. Three plots were laid out in the area. Area 3 was located on the site of an old logging camp, on the north side of the Stanislaus River. The area was level, free from brush, much exposed to the sun, and represented G. roezli under optimum growing conditions. Two plots were laid out in Area 3. In addition to the plots on the South Fork of the Stanislaus, six plots were established at Leland Meadow to provide data on the shade type of G. roezli and R. nevadense. In order to avoid repetition, Ribes data, which were taken over these plots, will be presented at a later date together with the final data on the results of the chemicals. A tabulated summary of the experiments performed over the above plots and weather records are given in tables 6 and 7, respectively.

TABLE NO. 6

SUMMARY OF EXPERIMENTAL SPRAYING OVER PLOTS ON SOUTH FORK OF STANISLAUS RIVER AND LELAND MEADOW, CALIFORNIA, 1928.

Date of Application	Plot Number	Chemical Used	Concentration Percentage by Volume	How Applied	Gallons Used	pH of Spray
June 20	Area I I A (0-1)	$NaClO_3$ $CaCl_2$	33% 47%	Spray	10.5	>9
" 21	I A (1-2)	$NaClO_3$ $CaCl_2$	33% 60%	"	8	>9
" 21	I B (0-1)	$NaClO_3$ $CaCl_2$	33% 36%	"	7	>9
" 21	I B (1-2)	$NaClO_3$ NH_4Cl	33% <M 12%	"	6	5.6
" 23	I B (2-3)	$NaClO_3$ NH_4Cl	33% M 18%	"	7	5.6
" 23	I A (2-3)	$NaClO_3$ NH_4Cl	33% >M 24%	"	3	5.6
" 25	II [illegible] (0-1)	$NaClO_3$ $Na_2Cr_2O_7$	17.6% 5.[illegible]	"	10	
" 25	II B (0-1)	$NaClO_3$	30[illegible]	"	1.5	
" 25	II [illegible] (2-3)	$NaClO_3$ [illegible]	17.[illegible] 5.3%	"	6.5	
" 26	II [illegible] (1-2)	$NaClO_3$	1[illegible]	"	4	[illegible]9
" 26	II B (2-3)	$NaClO_3$ $KMnO_4$	18% 5.3%	"	3	
" 26	I A (1-1a)	NH_4Cl $Na_2Cr_2O_7$	11% 5.3%	"	5.5	
" 26	I A (1a-1b)	NH_4Cl	15%	"	4	5.5
" 26	I [illegible] (1b-2)	[illegible]Cl	Sat.	"	5	5.6
" 27	I A (0-1)	[illegible]	15%	"	11	5.9
" 27	I [illegible] (1-1.5)	NH_4Cl	Sat.	"	4	5.8
" 27	I [illegible] (1.5-2)	NH_4Cl $Na_2Cr_2O_7$	11% 5%	"	3	
" 27	I B (0-1)	NaOCl	1/4 Strength	"	4	
" 27	II [illegible] (2-3)	NaOCl	1/2 Strength	"	2	
" 27	II B (2-3)	NaOCl	Full Strength	"	4	
" 28	I A (2-3)	$(NH_4)_2S_2O_8$ NH_4Cl	11% 5%	"	3	
" 28	I B (1-1.5)	$NaClO_3$ NH_4Cl	33% M	"	3	
" 28	I B (1.5-2)	$NaClO_3$ NH_4Cl	33% 12%	"	5	
" 29	I B (2-3)	$NaClO_3$ $CaCl_2$	33% M 35%	"	5	
" 29	II A (1-2)	$NaClO_3$ $CaCl_2$	33% <M 20%	"	4	
" 29	II A (0-1)	$NaClO_3$ $CaCl_2$	33% >M 40%	"	5	
" 29	II B (0-1)	$NaClO_3$ NH_4Cl	33% >M 20%	"	1	
" 29	II B (1-2)	$KMnO_4$ [illegible]	5.3% 1%	"	4	
" 30	Area II II [illegible] (0-1)	NaOCl	Full Strength	"	1	
" 30	II B (0-1)	NaOCl	1/2 Strength	"	2	
" 30	II B (3-4)	Na[illegible]	11[illegible]	"	2	
July 2	II B (6-6.6)	$KMnO_4$ $C_2H_4O_2$	11[illegible] 1[illegible]	"	1	
" 2	[illegible] B (4-5)	$(NH_4)_2S_2O_8$ $C_2H_4O_2$	11[illegible] 2[illegible]	"	3	
" 3 & 5	II A (1-2)	$NaClO_3$ $CaCl_2$	33[illegible] <M 20%	"	6	<4.4
" 3 & 5	II [illegible] (2-3)	$NaClO_3$ $CaCl_2$	33% M 35%	"	8	<4.4
" 5	II A (3-4)	$NaClO_3$ NH_4Cl	33% M 15%	"	3.5	>9
" 5	II A (4-5)	$NaClO_3$ NH_4Cl	33% >M 24%	"	6	>9
July 5	II [illegible] (6-6.6)	$NaClO_3$ NH_4Cl	33% <M 12%	Spray	1	>9
" 6 & 7	I A (0-1)	$NaClO_3$ NH_4Cl	33% M 16%	"	6	<4.4
" 6 & 7	I A (1-2)	$NaClO_3$ NH_4Cl	33% >M 24%	"	7	<4.4
" 6 & 7	II B (1-2)	[illegible]	Sat.	"	9	>9
" 6 & 7	II B (1-2)	$Na_2B_4O_7$ NH_4Cl	Sat. 11%	"	3	>9
" 8 & 9	II B (2-3)	NaOCl	1/4	"	8	
" 9	II B (5-5.6)	$Na_2B_4O_7$ $KMnO_4$	Sat. 2%	"	3	
" 9	II B (5.6-6)	$Na_2Cr_2O_7$ NaOH	10% 2%	"	1	
" 9	III A (0-1)	$Na_2Cr_2O_7$ H_2SO_4	11% 5%	"	2.5	
" 9	III B (0-1)	$Na_2Cr_2O_7$ NaOH	11% 2%	"	2	
" 11	III A (1-2)	$Na_2B_4O_7$ [illegible]	Sat. 2%	"	1	
" 11	I A (2-3)	$NaClO_3$ NH_4Cl	33% 12% <M	"	3	<4.4
" 11	[illegible] B (0-1)	$NaClO_3$ [illegible]Cl	33% 16% M	"	1	>9
" 11	I B (1-2)	$NaClO_3$ NH_4Cl	33% 24% >M	"	3	>9
" 11	[illegible] B (2-3)	$NaClO_3$ [illegible]Cl	33% 12% <M	"	3	>9
" 11	III B (1-2)	[illegible]O_7	Sat.	"	1.5	9
" 26	Leland Meadow III [illegible] (0-1)	[illegible]$aClO_3$	42.8%	"	5	12
" 26	III A (1-2)	$NaClO_3$	25%	"	2	12
" 26	III [illegible] (2-3)	$NaClO_3$	17%	"	4	12
" 27	III [illegible] (3-4)	$NaClO_3$	42.8%	"	4	2
" 27	III [illegible] (4-5)	[illegible]$aClO_3$	25%	"	3	2
" 27	III [illegible] (5-6)	$NaClO_3$	17%	"	2	2
" 27	III A (6-6.6)	NH_4Cl	Sat.	"	2	2
" 28	Leland Meadow IX [illegible] ([illegible])	$NaClO_3$ $CaCl_2$	33% >M	"	6	12
" 28	IX A (1-2)	$NaClO_3$ $CaCl_2$	33% <M	"	3.5	12
" 28	IX B (0-[illegible])	$NaClO_3$ $CaCl_2$	33% M	"	3	12
" 28	IX B (1-2)	$NaClO_3$ Furfural	33% 2%	"	3.5	7
" 29	Leland Meadow I [illegible] (0-1)	$NaClO_3$ Furfural	17.5% 1%	"	5	7
" 29	[illegible] A (1-2)	$NaClO_3$ Furfural	17.5% 2%	"	9	7
" 29	I A (2-3)	$NaClO_3$ Furfural	25% 1%	"	3	7
" 29	Leland Meadow IV B (0-1)	$NaClO_3$ Furfural	25% 2%	"	6	7
" 29	IV B (1-1.5)	$NaClO_3$ NaOH	33% 2%	"	11	
" 30	IV B (1.5-2)	$NaClO_3$ NaOH	33% 1%	"	6	
" 30	IV A (0-.7)	Furfural	5%	"	6	
" 30	IV A (.7-1)	$NaClO_3$ NH_4Cl Furfural	25% 17.6% 2%	"	7	
" 30	V B (0-1)	$NaClO_3$ NH_4Cl Furfural	12.5% 15% 0.5%	"	4	
August 2	Manzanita and Ceanothus Western edge of meadow. Marked with stake.	$NaClO_3$	25%	"	4	

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TABLE NO. 7

SOIL TEMPERATURE, RELATIVE HUMIDITY AND WEATHER LOG AT STRAWBERRY AND LELAND MEADOW, STANISLAUS NATIONAL FOREST, CALIFORNIA. - 1928.

Date	Soil Temperature 7:30 a.m.	Noon	4:30 p.m.	Relative Humidity 7:30 a.m.	Noon	4:30 p.m.	Weather Log
	In Degrees Fahrenheit						
June 8	52	-	55	63	-	44	Sunny, clear
" 9	48	-	57	47	-	38	A.M. Sunny, p.m. cloudy.
" 10	51	51	50	41	45	86	A.M.cloudy,str.E.W.p.m.Hail,Snow
" 11	46	48	51	91	85	93	Sky clearing up
" 12	45	-	51	88	58	59	Sky clear.Sky with large clouds
" 13	48	50	51	46	38	52	Sky almost cloudless,stiff SW.W.
" 14	49	-	53	65	-	44	Sky clear
" 15	48	-	53	69	-	68	Sky clear
" 16	48	-	53.5	70	78	32	Sky clear, warm day
" 17	49	-	54	58	34	46	Clear, str. SW. wind
" 18	50	-	54	59	-	60	Cloudy, str. SW. wind
" 19	48	-	-	57	46	-	Clear, str. SW. wind
" 20	50	-	54	86	33	45	Sky clear
" 21	48	-	54	71	56	42	NE. wind, Sky clear
" 22	50	52	57	74	52	51	Sky clear, SW. wind
" 23	51	-	57	75	36	46	Sky clear, NE. wind
" 24	-	55	56	-	49	55	Sky clear
" 25	52	-	56	81	43	43	Sky clear
" 26	51	-	54	78	37	52	Sky clear
" 27	50	-	-	58	61	-	N.W. wind
" 28	50	-	50	79	60	57	Clear,a.m.Cloudy,SW wind,p.m.
" 29	50	-	54	64	58	47	Sky clear SW wind
" 30	50	-	-	60	62	-	Cloudy SW wind
July 1	49	53	53	74	51	53	Cloudy a.m. Clear p.m.
" 2	50	-	54	74	52	59	Sky clear,Sky cloudy SW.W.S.Clear
" 3	51	-	-	49	51	-	Sky clear
" 4	50	-	-	69	-	-	Sky clear
" 5	51	-	-	64	54	-	Sky clear
All subsequent observations at 7 a.m. 1 p.m. 7 p.m.							
" 6	50	-	56	52	46	49	Sky clear
" 7	-	-	-	57	47	-	Sky clear SW wind
" 8	-	-	-	-	-	-	-
" 9	-	-	-	-	-	-	-
" 10	-	-	-	-	-	-	-
" 11	54	-	-	65	-	-	Sky clear
" 12	54	58	58	-	-	-	Sky clear
" 13	-	-	-	-	-	-	Sky clear
" 14	57	63	56	66	54	64	Sky cloudy
" 15	57	61	57	53	64	62	Sky cloudy
" 16	59	-	58	60	38	66	Sky clear
" 17	56	-	56	63	37	60	Sky clear
" 18	56	-	56	66	46	61	Sky clear
" 19	54	-	55	60	46	60	Sky clear
" 20	54	-	56	63	54	56	Sky clear
" 21	53	-	56	64	44	54	Sky clear
" 22	-	-	-	-	-	-	Sky clear
Cow Creek Ranger Station							
" 23	54	59	55	56	34	50	Sky clear
" 24	54	-	57	53	36	48	Sky clear
" 25	56	-	56	53	34	46	Sky clear
" 26	58	-	63	64	44	63	Sky clear
" 27	60	-	63	68	49	62	Sky clear
" 28	61	-	60	67	46	67	Sky clear

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VII. Experimental Work in Oregon

Experiments in chemical eradication were undertaken primarily to ascertain the reaction of R. bracteosum to chemicals which had proved successful on R. petiolare in Idaho. The difficulties involved in the hand eradication of R. bracteosum suggested that chemical methods would provide a more economical method of eradication where the species occurred in heavy concentration. Experimental plots were established on the Still Creek eradication area, and experiments conducted over the period of July 17 to August 1. The work was made possible through the active cooperation of L. N. Goodding.

Plots were laid out as usual. Two areas were selected. Area 1 was due east of camp and represented the extreme shade type of R. bracteosum and R. lacustre. Area 2 was near Veda Lake on a small stream and was open and free from large brush. In this open location R. lacustre grew prostrate in large mats, while R. bracteosum formed solid patches four feet high and six or seven feet square.

Area 1. The R. bracteosum in Plot I totalled 7,806 feet of live stem. In the same plot there were 74 R. lacustre having 3,060 feet of live stem. In Plot 2 there were 78 bushes of R. bracteosum having a total of live stem of 1,516 feet. On this same plot 20 R. lacustre totalled 788 feet.

Area 2. In this area there were 201 R. bracteosum with a total of 8,690 feet of live stem and 413 R. lacustre totalling 31,875 feet.

Examination of the work on August 10 showed that R. bracteosum was behaving very much like R. petiolare. Complete defoliation and death of considerable live stem had taken place and there were no signs of releafing or sprouting. R. lacustre responded to treatment pretty much as it did in Idaho. A summary of the experimental spraying is given in Table No. 8.

TABLE NO. 8.

SUMMARY OF EXPERIMENTAL SPRAYING DONE AT STILL CREEK, OREGON, 1928

Date of Application	Plot No.	Chemical Used	Concentration Percentage by Volume	How Applied	Gallons Used
July 25	Area I I A (0-1)	$NaClO_3$+ $CaCl_2$	33 M	Spray	12
" 26	I A (1-2)	$NaClO_3$	15	"	3
" 26	I A (2-3)	$NaClO_3$+ $NaOH$	15 2	"	1
" 26	I B (0-1)	$NaClO_3$+ $CaCl_2$	33 >M	"	2
" 26	I B (1-2)	$NaClO_3$+ $NaOH$	25 2	"	1
" 26	I B (2-3)	$NaClO_3$+ $NaOH$	10 2	"	1
" 26	II A (0-1)	$NaClO_3$	25	"	3.5
" 26	II A (1-2)	$NaClO_3$+ $CaCl_2$	33 <M	"	6
" 27	Area II I A (0-1)	$NaClO_3$+ $CaCl_2$	33 M	"	6
" 27	I A (1-2)	$NaClO_3$+ $NaOH$	10 2	"	11
" 28	I B (0-1)	$NaClO_3$+ $NaOH$	10 5	"	1
" 28	I B (1-2)	$NaClO_3$	10	"	10
" 28	I B (2-3)	$NaClO_3$	20	"	19
" 30	I B (3-4)	$NaClO_3$+ $NaOH$	25 2	"	17
" 30	I A (2-3)	$NaClO_3$+ $NaOH$	15 2	"	12
" 31	I A (3-4)	$NaClO_3$+ $NaOH$	20 2	"	11
" 31	I A (3-4)	$NaClO_3$	20	"	2
	Area II Pt. II. One Bush R. sanguineum	$NaClO_3$	20	"	2

VIII. Cost of Project, September 1, 1927 to August 31, 1928.

Table No. 9, which follows, gives the various items which constitute the total cost of all field and laboratory work of this project.

TABLE NO. 9

ITEMIZED COST OF PROJECT

Item	Field Experimental Work	Laboratory Work	Total
Salaries	$ 1,810.25	$3,306.15	$5,116.40
Transportation and subsistence	1,696.90	--	1,696.90
Special equipment	147.05	206.77	353.82
General equipment, 1926 charge	17.53	--	17.53
General equipment, 1927 charge	87.58	--	87.58
General equipment, 1928 charge	82.93	--	82.93
Chemicals	181.97	72.61	254.58
Car operation (Nos. 3 and 5)	215.74	--	215.74
Freight and express	35.51	--	35.51
Total	$4,275.46	$3,585.53	$7,860.99

IX. Summary of Observations Made Over Experimental Plots

The toxic action of sodium chlorate differs markedly from all other Ribicides which have been tested. A highly toxic chemical (sodium hydroxide) or an extremely poisonous chemical (mercuric chloride) are not always the best destructive agents of plant life. Both of these chemicals effected very rapid and complete defoliation, but did not result in any permanent injury to the plants. Ribes put out new leaves and buds in almost direct ratio to the speed of defoliation. Oxidizing agents such as sodium dichromate, potassium permanganate, oxalic acid and ammonium persulphate, which might be expected to act similarly to sodium chlorate, did not cause permanent injury to the Ribes. Ammonium salts were found to act rather slowly, lowered the vitality of the plants considerably, and in the initial stages compared favorably with the toxic action exerted by the chlorates. The year following application of the ammonium salts, however, found most of the sprayed Ribes in a fairly vigorous growing condition. It appears that *R. petiolare* can be completely eradicated by a 10% solution of sodium chlorate, if the spray is made slightly acid (pH 2). Efficiency on *G. inermis* and *R. lacustre*, on the other hand, seems to be increased if the spray is made alkaline (1N), while an acid solution (1N) reduces that efficiency. Alkaline chlorate solutions are not so effective as acid chlorate solutions on *R. petiolare.* Results of the spray on different Ribes can be markedly affected by adjusting the pH value of the solution.

The addition of calcium chloride, which serves as an hygroscopic agent to the chlorate spray, appears to reduce the toxic action on *G. inermis*, *R. lacustre* and *R. viscosissimum.* When the chlorate is added to the mixture so that the resulting calcium chlorate approximates

W. 686. G.inermis sprayed with sodium chlorate 25% in early July, 1925. Not sprayed in 1926. Resprayed with same solution in late June, 1927. No evidence of renewed growth. Picture taken August 4, 1927. Santa, Idaho.

W. 444. Showing effect of chemical on G.inermis. Sprayed with $KMnO_4$, 5%; $NaClO_3$, 20%. Santa, Idaho.

20-25% sodium chlorate, no appreciable lowering of the toxicity on R. petiolare was observed. It appears unlikely, however, that a solution lower than 20% can be successfully used where the calcium chloride is added, whereas a 10% solution of sodium chlorate alone, if made slightly acid, effects complete eradication of R. petiolare. A solution of chlorate containing 2% by weight of sodium hydroxide is very toxic to G. inermis and R. lacustre. This addition of sodium hydroxide also leaves a film of moisture on the leaves for several days and considerably reduces the fire hazard for that period. The caustic solution, however, is rather unpleasant to handle and is corrosive to equipment and clothing. Certain data also suggest that the alkaline solution is more attractive to animals grazing over sprayed areas than is the sodium chlorate alone. The combination of two types of oxidizing agents, the passive sodium chlorate with an active ingredient such as permanganate or sodium hydroxide, makes the spray much more toxic to G. inermis and R. lacustre and some of the above mentioned attendant difficulties can probably be surmounted. Early observations of experimental work in California show that alkaline solutions of sodium chlorate are very effective on R. nevadense. R. nevadense is much more susceptible to the neutral chlorate if application is made very early in the growing season. G. roezli shows more resistence. Experiments made at Still Creek, Oregon, on R. bracteosum, indicate that this species is similar to R. petiolare in its reaction to sodium chlorate.

X. Recommendations.

The writer, after summarizing data of the past three years work, recommends that sodium chlorate 10% (pH 2) be used for the eradication of R. petiolare and sodium chlorate 25% in 1N alkaline solution be used for the eradication of G. inermis and R. lacustre. It is hoped, however, that the research work as outlined under XI of this report will devise a more satisfactory hygroscopic agent than $CaCl_2$ for Ribes eradication, and that new Ribicides will come to light to replace entirely the inflammable $NaClO_3$.

XI. Outline of Research Work to be Conducted at Berkeley, Winter of 1928 - 1929.

A. Chemical

Ribes Work

1. Qualitative and possible subsequent quantitative determination of small amounts of sodium chlorate in stems and roots of sprayed plants. Analysis of succulent material, woody stems and roots.

Method. Dialysis and water extraction with indicator test of indigo sulphate in sulphurous acid, diphenylamine, etc. Initial work on R. petiolare, G. inermis, G. roezli and R. nevadense.

Purpose. Method to be used for the detection of small amounts of sodium chlorate in program of physiological studies. Data to indicate if sodium chlorate is being used up within the plant following penetration.

2. Determination of the quantity of sodium chlorate remaining on the surface of leaves and stems after different time intervals and the amount of chlorate which actually penetrates the leaves.

Method. Frankford Arsenal method for chlorate and Mohr's method for chloride.

Purpose. To arrive at an understanding of the hazardous period following application of sodium chlorate in the field.

3. Injections of sodium chlorate into stems of various Ribes.

Method. Injection by means of pressure and application after cutting different protective tissues.

Purpose. To note the results in the way of killing, and to follow the movement of the chemical after treatment.

4. Testing of hygroscopic sprays after Nitella experiments have shown that hygroscopic agent does not reduce toxicity.

Method. Sprays to be tested on greenhouse Ribes and duration of film of moisture noted under different degrees of humidity.

Purpose. To reduce the attendant fire risks of large scale applications of sodium chlorate.

Nitella Work

5. Studies on the addition of various salts which lower the surface tension of their action on the toxic effect of chlorates on Nitella. Special attention to be paid to magnesium chloride, magnesium sulphate, glycerine, molasses, caramel, etc.

Method. Toxicity to be measured by the outward diffusion of the chlorine from the cells and by pH measurements.

Purpose. To provide a basis for the selection of more satisfactory hygroscopic agents than those already in use.

6. Studies of the effect of the addition of certain toxic cations in combination with non-toxic anion, e.g. Al, Mg, Zn, Co. as nitrates.

Method. As in 5.

Purpose. To provide a basis for the selection of suitable catalyzers of the toxic action of sodium chlorate.

Chemical Examination of Ribes Tissue and Extracts

7. Completion of chemical analysis of Ribes stems and leaves.

8. Redetermination of the tannins in four northern Ribes by Official Method and by the method of Wilson and Kern. Tannin determination of fresh sample of *R. alpinum.*

9. Preparation of Ribes tannin extracts to be used in the following studies:

a. Physico-chemical properties of Ribes tannins.

Purpose. Correlation of existing data concerning the effectiveness of sprays of different pH values with the characteristics of tannins in plants.

b. Continuation of topic 9a with particular reference to the effect of the ions Ca, Cl, NH_4, SO_4 on the solubility of tannins.

Purpose. Correlation of existing data on effectiveness of various sprays already tested with the characteristics of tannins present.

c. Continuation of topics 9a and 9b with particular reference to the effect of certain organic substances, (e.g. H.COOH, $H_2C_2O_4$,dextrose, etc.)

Purpose. Basis for the selection of complex ions to be added to the spray mixture.

d. Reactions of Ribes tannins with sodium chlorate in different pH media.

Purpose. Explanation of function of tannins in protecting plants from injury by sodium chlorate.

e. Investigation of tannin-starch and tannin-sugar mixtures by polariscope.

Purpose. Correlation of chemical data to account for the disappearance of starch after treatment with sodium chlorate and detection of the possible intermediate compounds of translocation.

10. Investigation of the identity of bichromate-tannin and gelatin-tannin precipitate.

Purpose. Justification of the bichromate method of staining Ribes tissue for tannins.

11. Investigation of the non-tannin fraction.

Purpose. Search for portion of fraction not accounted for in Ribes analysis.

Fireproofing of Clothing

12. Search through literature for available non-combustible clothing and other substances rendering cloth impermeable or non-combustible.

13. Treatment of cloth with various mineral substances, e.g. stannic hydrate, aluminum hydrate, silica, tungstates, etc.

Method. Precipitate as mineral jellies in cloth.

Purpose. To minimize the fire risk to the men applying the chlorate under field conditions.

B. Physiological.

1. Comparative studies on the toxic action of $NaClO_3$ and As_2O_3 on cut stems of *R. petiolare* and *G. inermis* and wild morning glory.

Method. As used in studies of morning glory.

Purpose. To find out if the action of the above chemicals is similarly effective on Ribes and morning glory and to make use, if possible, of the data already available on wild morning glory.

W. 447. R. petiolare dying. Sprayed with $NaClO_3$, 20%; pH 7, Santa, Idaho.

W. 443. Showing R. lacustre releafing after being sprayed with a saturated solution of NaOCl., Santa, Idaho.

2. Physiological examination of Ribes as follows:

Function of Plant	In Reference To
Respiration	Utilization of stored foods.
"	Effect of chlorate upon.
Transpiration	Water relations in the xylem.
"	Possibility of using deficit in the xylem to inject toxic materials into the root.
Growth	Starch cycle.
Organic nutrients a. Photosynthesis b. Translocation c. Storage	Proper time for spraying with reference to the utilization and storage of foods.

Method. General methods for the measurement of CO_2 and water with correlation of histological examinations.

Purpose. To trace the course of toxic action of the chemical thru the plant, and to ascertain the most favorable time for application.

3. Examination of the work done by F. A. Patty and Mrs. Webber in the light of the above physiological experiments according to the following scheme:

Part of Plant	Portion	Related To
Leaf	Surface	Wetting and penetration.
"	Vascular anatomy	Penetration into and conduction.
"	General anatomy	Route of conduction of organic nutrients.
Stem	Surface	Wetting and penetration.
"	Xylem	Conduction and water relations.
"	Phloem and cortex	Movement of organic nutrients.
"	Storage tissues	Organic nutrition as affected by treatment.
Roots	General anatomy	Conduction of nutrients and toxic substances.
"	Storage tissues	Effect of treatment on reserves.

4. Physico-chemical problems already under consideration and having particular reference to the above physiological work.

a. Effect of surface tension upon wetting, and the penetration and resulting toxicity of spray solutions.

b. Effect of pH on the permeability of various Ribes tissues, and the resulting effects on penetration and toxicity.

c. Fixation of spray materials, or alteration of spray materials, and products of chemical reactions as related to toxic effects. e.g. reactions involved between sodium chlorate and starches, sugars, tannins and plant acids.

C. Morphological

1. Determination of the best methods of sectioning and staining different Ribes species used in experimental chemical eradication studies.

2. Permanent slides to be made of Ribes leaf and stem tissues to provide a complete anatomical picture of the plant. Microphotographs of all good typical slides to be made.

Method. Standard procedures to be used with such departures as are necessitated by the particular nature of the material being used.

Purpose. To arrive at an understanding of a structural difference which may exist between the various Ribes species as a possible basis for previously observed difference in reaction to toxic chemicals. To assist in the correlation of chemical and physiological data. The above work should be performed keeping particularly in mind topic 3 of the outline for physiological work.

SCOUTING FOR BLISTER RUST IN BRITISH COLUMBIA - 1928

By

H. N. Putnam, Associate Pathologist

INTRODUCTION

Owing to the fact that blister rust was found this season quite well distributed over the Idaho white pine belt, there was no necessity for scouting in southeastern British Columbia to determine the spread of the rust southward.

The only inspection of host plants made in southeastern British Columbia in 1928 was that done by members of the scouting project July 7 to 10, near Nelson, B. C. This trip was made for the purpose of familiarizing the men with the appearance of the disease in its various aspects and the classification of cankers. No new infections were found. The infections at Willow Point, B. C. and at Proctor B. C. were studied.

I. Results

In Table No. 1 is shown the results of the inspection of the three previously known pine infections.

TABLE NO. 1

RECORD OF INFECTIONS AT WILLOW POINT AND PROCTOR, B. C., AS FOUND ON JULY 7 AND 8, 1928

Place	Ribes Inspection				White Pine Inspection			
	Species	Exam.	Inf.	% Leaves Inf.Per Inf.Bush	Exam.	Inf.	% Pines Infected	Cankers Per Inf. Tree
Willow Point	R.nigrum	10	10	1%	326	17	5.2%	1.7
East Proctor	R.nigrum	4	4	10%	142	4	2.8%	1.3
" "	Cult.Red Currant	1	0					
West Proctor	R.lac.	2	2	75%	142	7	4.9%	2.3

The heavily infected R.lacustre bushes were growing in nearly complete shade within 15 feet of infected pines. The record of pine infection is not representative of true infection conditions, since cankers found in 1926 at these places were cut out and destroyed. The cankers found in 1928 represent chiefly those developed since 1926.

II. Costs

Table No. 2 gives the costs of this work.

TABLE NO. 2

COSTS OF SCOUTING FOR BLISTER RUST, BRITISH COLUMBIA, JULY 7 to 10, 1928

Salaries	Expenses	Total
$80.34	$96.66	$177.00

III. Conclusion

No scouting for blister rust was done in southeastern British Columbia, other than an inspection of previously found pine infections. This inspection was made for the purpose of familiarizing the scouts with blister rust.

DAMAGE TO PINE STUDIES

by

H. N. Putnam,

Associate Pathologist.

INTRODUCTION

Under the heading "Damage to Pine Studies" are included several related studies, which will be reported on individually. These several subjects are listed following:

I. Progress Report on Cheekye Plot, Cheekye, B. C.
II. Study of Relative Susceptibility of Pinus monticola and P. strobus Growing Under Western Conditions.
III. Pine Infection Study at Spirit Lake, Washington.
IV. Infecting power of Ribes lacustre and R. viscosissimum.
V. Newman Lake Plot, Washington.

I. Progress Report on Cheekye Plot, Cheekye, B. C.

A. Statement of Work Performed.

1. Work in spring, 1928. In May, 1928 the plot was gone over for Ribes. The planted pines were examined for survival and blister rust.

2. Work in fall, 1928. In October, 1928 the planted pines were again examined for blister rust.

B. Results.

1. Re-eradication in the spring, 1928. Tables No. 1 and 2 show the number of seedlings and their average heights by year of germination.

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B. Results.

1. Re-eradication in the spring, 1928. Tables No. 1 and 2 show the number of seedlings and their average heights by year of germination.

TABLE NO. 1

NUMBER OF RIBES SEEDLINGS FOUND AND ERADICATED ON PLOT - SPRING 1928

Degree of Burn	Quadrant	Ribes Species	Number of Seedlings Per Year of Origin				
			1925	1926	1927	1928	Total
Duff Partially Burned	N.E.	R.sang.	2	71		17	93
	S.E.	R.sang.		301	59	4	
		R.lac.		2			
	S.W.	R.sang.	1				1
	N.W.	R.sang.		14			14
	Total	R.sang.	3	386	62	21	472
		R.lac.		2			2
Duff Totally Burned	S.E.	R.sang.		22			56
	S.W.	R.sang.	1	3	2		6
	N.W.	R.sang.		3			
	Total	R.sang.	1	28	2	34	65
Grand Total		R.sang.	4	414	64	55	537
		R.lac.		2			2

The Ribes seedlings of 1925 and 1926 origin found in 1928 were present and overlooked in 1927. They were doubtless very small in 1927. Table No. 2 gives the average heights of the seedlings found in 1928, compared to the heights of seedlings found in 1927.

TABLE NO. 2

AVERAGE HEIGHTS OF RIBES SANGUINEUM SEEDLINGS FOUND IN 1927 AND 1928 CLASSIFIED BY YEARS OF ORIGIN

Year Found	Average Heights of R.sanguineum Seedlings Originating in			
	1925	1926	1927	1928
1927	.75 feet	.18 feet	.02 feet	
1928	.38 feet	.12 feet	.09 feet	.01 foot

It is quite strikingly brought out in Table No. 2 that the average heights of the Ribes sanguineum seedlings of the same year's germination found in 1928 were much smaller than those of the seedlings found in 1927, in spite of the fact that such seedlings were one year older.

No relationship was apparent between the Ribes seedlings found on the plot and the infection on the planted pines.

2. Examination of Planted Pines. Table No. 3 shows the per cent of pines planted in the spring of 1926 which were living in the fall of 1927 and fall of 1928. It may be observed that there was a loss of $16\frac{3}{4}$ per cent during the first year and one-half, and only an additional loss of .5 per cent two and one-half years after planting.

TABLE NO. 3

PER CENT SURVIVAL OF PINES PLANTED ON CHEEKYE PLOT

Radius	Pines Planted Spring 1926	Per Cent Survival Fall 1927	Per Cent Survival Fall 1928
North	771	92	90
N. E.	640	88	85
East	528	87	85
S. E.	660	83	82
South	515	82	81
S. W.	660	70	70
West	477	78	*84
N. W.	726	84	84
Total	4977	83.26	82.74

*The reason for the increase in per cent survival of pines on the west radius in 1928 over 1927 lies in the fact that several pines were found in the fall of 1928 which were too small to be found in 1927. This situation was due to the dense growth of unburned material on a portion of the west radius.

In Table No. 4 the pines on each radius have been divided into three classifications: (1) those outside the plot; (2) those on the plot from the circumference to 920 feet in, termed the "Protection Zone"; and (3) those on the plot inside an inner circle having a radius of 330 feet, termed the "Area Protected". This classification is arbitrarily based on the 900-ft. protective strip used in the East.

TABLE NO. 4.

RECORD OF INFECTION OF PLANTED PINES ON CHEEKYE PLOT, B.C., OCTOBER 12-15 1928

Radius	Outside Plot			Protection Zone (920 feet in width)			Area Protected (Inner circle 330 ft. radius)			Total Pines		
	Pines Exam.	Pines Infec.	% Pines Infec.	Pines Exam.	Pines Infec.	% Pines Infec.	Pines Exam.	Pines Infec.	% Pines Infec.	Pines Exam.	Pines Infec.	% Pines Infec.
North	310	28	9.0	286	17	5.9	96	2	2.1	692	47	6.8
N. E.	195	7	3.6	258	13	5.0	93	4	4.3	546	24	4.4
East	85	5	5.9	268	24	9.0	98	5	5.1	451	34	7.5
S. E.	173	6	3.5	263	22	8.4	103	4	3.9	539	32	5.9
South	60	0	0.0	251	9	3.6	105	4	3.8	416	13	3.1
S. W.	114	4	3.5	259	7	2.7	91	3	3.3	464	14	3.0
West	65	4	6.2	234	25	10.6	101	9	8.9	400	38	9.5
N. W.	258	15	5.8	260	17	6.5	93	9	9.7	611	41	6.7
Total	1,260	69	5.5	2,079	134	6.4	780	40	5.1	4,119	243	5.9

W. 473. Study area to determine the relative susceptibility of P. monticola and P. strobus. Buck Creek, upper Stilliguamish River, Washington. Picture taken April, 1928.

W. 17. Control Demonstration Plot, Cheekye, B. C., 2 years after burning which occurred on September 26, 1925. Looking toward north from rock near center of plot.

It may be observed from Table No. 4 that the per cent of pines infected on the non-eradicated area outside the plot, is less than the per cent of pines infected in the "Protection Zone". This condition is partially, at least, due to the fact that the portions of the radii extending beyond the plot are often screened by unburned material.

The only conclusion possible from data presented in Table No. 4 is that under the moist conditions that obtain at Cheekye, 900 feet or even 1250 feet does not constitute a protection strip sufficient to protect white pines from blister rust.

An interesting and unusual canker development was found. On October 14, 1928 one of the planted pines showed a canker in the process of producing aecia for the first time. There were three blisters, one of which had not opened. Very few of the aeciospores in the two opened blisters had escaped.

II. Study of Relative Susceptibility of Pinus monticola and P. strobus Growing Under Western Conditions

A. Purpose.

To study the relative susceptibility of *Pinus monticola* and *P. strobus* in the West.

B. Location and Description of Areas.

Two areas were found on which both pine species were associated and with infection present.

1. Buck Creek Plot. This area is located on the south fork of the Stilliguamish River, Snoqualmie National Forest, Snohomish County, Washington. In 1910 the Forest Service planted *P. strobus* and *P. monticola* here. In 1914 the area was partially burned over. The elevation is approximately 2,000 feet, sufficiently high to receive abundant snowfall. The plot occupies 1.6 acres. *Ribes bracteosum* and *R. lacustre* occur in abundance on one side of the plot. The plot was established on June 20, 1928, and re-examined on October 10, 1928.

2. Pysht Plot. This area is located at the logging camp of Merrill and Ring Lumber Company, Pysht, Clallam County, Washington. The elevation is only 50 feet above sea level, in a region of very abundant rainfall, and very little snow.

In 1919 Mr. Merrill, of the Merrill and Ring Lumber Company, planted a mixture of *P. monticola* and *P. strobus* seeds in 3 rows three feet apart. The trees remaining of this planting are the ones being studied.

Grossularia divaricata, R.bracteosum and R.laxiflorum occur within 25 to 300 feet from the rows of pines.

This study area was established on May 29, 1928, and re-examined on October 18, 1928.

C. Methods of Work.

These study areas were laid out as permanent plots with the thought in mind of making annual examinations so long as it is deemed necessary. The pines and Ribes were plotted and tagged with numbers. On the Buck Creek Plot the area was laid off in square chains and staked. At Pysht the rows of pines were plotted and all associated Ribes bushes located and plotted.

Data on pines relative to the age, height, crown class, years needles borne, feet of stem bearing needles, and size of crowns were taken.

Data on cankers included canker stage, year of growth infected, location on tree and size of canker.

Ribes data by species included shading, height, feet of live stem, number of leaves, per cent leaves infected, per cent infection per leaf, and per cent of infected surface bearing uredinia, telia and necrotic areas.

D. Results.

The following table shows the findings in regard to the relative susceptibility of the two pine species in question.

TABLE NO. 5

RELATIVE SUSCEPTIBILITY OF P.MONTICOLA AND P.STROBUS AS FOUND ON THE BUCK CREEK AND PYSHT AREAS

Plots	White Pine Species	Number of Trees		Per Cent Trees Infected	Cankers Per		Cankers Per 1,000 Ft. of Needle Stem
		Exam.	Infected		Infec. Tree	Total Trees	
Buck Creek	P.monticola	71	17	24	2.3	.55	1.25
	P.strobus	5	1	20	1.0	.2	.75
Pysht	P.monticola	76	41	54	4.0	2.18	20.51
	P.strobus	6	3	50	2.3	1.17	2.28
Both Plots Combined	P.monticola	147	58	39	3.5	1.4	5.21
	P.strobus	11	4	36	2.0	.7	1.82

Although the number of P.strobus on each plot is too small to form a sufficient basis, nevertheless the indications are that P.strobus is more resistant to the rust than is P.monticola. The pines whose susceptibility is compared were exposed to the same sources of sporidia. It may be observed that there were twice as many cankers per tree and approximately three times as many cankers per 1,000 feet of needle stem found on P.monticola as were found on P.strobus.

From an analysis of the canker development and year of growth infected it is judged that infection at Buck Creek originated in 1923 with annual infection thereafter. At Pysht infection apparently originated in 1923, followed by the main wave of infection in 1926. A few cankers obviously originating in 1927 were found.

While it is self-evident that the pine foliage in 1923 and other infection years was much less than is shown at present, nevertheless the proportional amounts of foliage of the two pine species would remain the same. Hence it is believed that the estimate of feet of needle stem serves as a good basic measure of pine infection.

III. PINE INFECTION STUDY AT SPIRIT LAKE, WASH.

A. Purpose.

The purpose of the study at Spirit Lake was simply to investigate the development of the rust when pines were closely associated with abundant growth of Ribes species in a region representative of the western white pine belt in the Cascades of Washington and Oregon. It included a study of killing cankers for trees of different sizes, and the development of a measure of pine infection.

B. Description of Area.

The plot is located on the Toutle River near Mt. St. Helens three miles west of Spirit Lake, on the Columbia National Forest, Skamania County, Washington, at an elevation of 2,500 feet.

The plot occupies practically all of an old homestead clearing consisting of 1.3 acres. It was cleared approximately twenty years ago and then abandoned. The area has come up to brush and white pine. It is surrounded with a mixed coniferous growth 61 to 80 years old. The alluvial soil is composed chiefly of decomposed pumice from Mt. St. Helens.

1. Ribes Conditions. Four species of Ribes occur on the plot, named in the order of their decreasing abundance: R.laxiflorum, R.lacustre, R.sanguineum and R.bracteosum. The first named species was very abundant,

growing in thick masses often thirty feet square. There were found only a few bushes of R. sanguineum and R. bracteosum.

2. Pine Conditions. White pines of various ages from five to twenty years were found moderately abundant over the plot. They were growing under average site conditions.

C. Methods of Work.

The plot was established in June, 1928. The same general method of plotting pines and Ribes species by square chains and the method of taking data were used as on the Buck Creek Plot.

D. Results.

1. Pine Infection. Analysis of the cankers found on the plot indicates that at least one canker originated from infection in 1918 or 1919. Apparently there developed a heavy wave of infection in 1925, with evidence of additional infection originating in 1926. In the close association with heavy Ribes growth, there are annual pine infections formed which make it difficult to pick out the waves of infection. Very little damage was apparent. The great majority of the cankers were in the early stages of development preceding the formation of pycnia.

In Table No. 6 is shown information relative to the pine infection found at Spirit Lake.

TABLE NO. 6

PINE INFECTION DATA AT SPIRIT LAKE, WASH.

Item	Total Pines	Healthy Pines	Infected Pines	Number of Cankers		
				Per Inf. Tree	Per Total Trees	Per 1000 Ft. Needle Stem
Number	123	66	57	10.2	4.7	21
Per Cent Pines Infected			46%			
Average Feet Needle Stem Per Tree	225	119	345			

It may be observed that the average size of infected trees is approximately three times that of the healthy trees. This is to be expected, since the amount of pine infection would be proportional to the amount of pine leafage exposed, other things being equal.

In Table No. 7 is shown the per cent of infected trees infected with killing cankers. As used in this report, a killing canker is defined

as a trunk canker, branch-trunk canker, or a branch canker whose center is not more than one and one-half feet from the trunk.

TABLE NO. 7

PER CENT OF INFECTED TREES HAVING KILLING CANKERS CLASSIFIED BY HEIGHT CLASSES, SPIRIT LAKE, WASHINGTON.

Height Class (Feet)	Total Infected Trees Studied	Trees with Killing Cankers	% of Infected Trees with Killing Cankers
1 - 5	12	11	92
5.1 - 10	17	13	76
10.1 - 15	8	3	37
15.1 - 20	6	5	83
20.1 - 25	2	0	0
Total	45	32	71

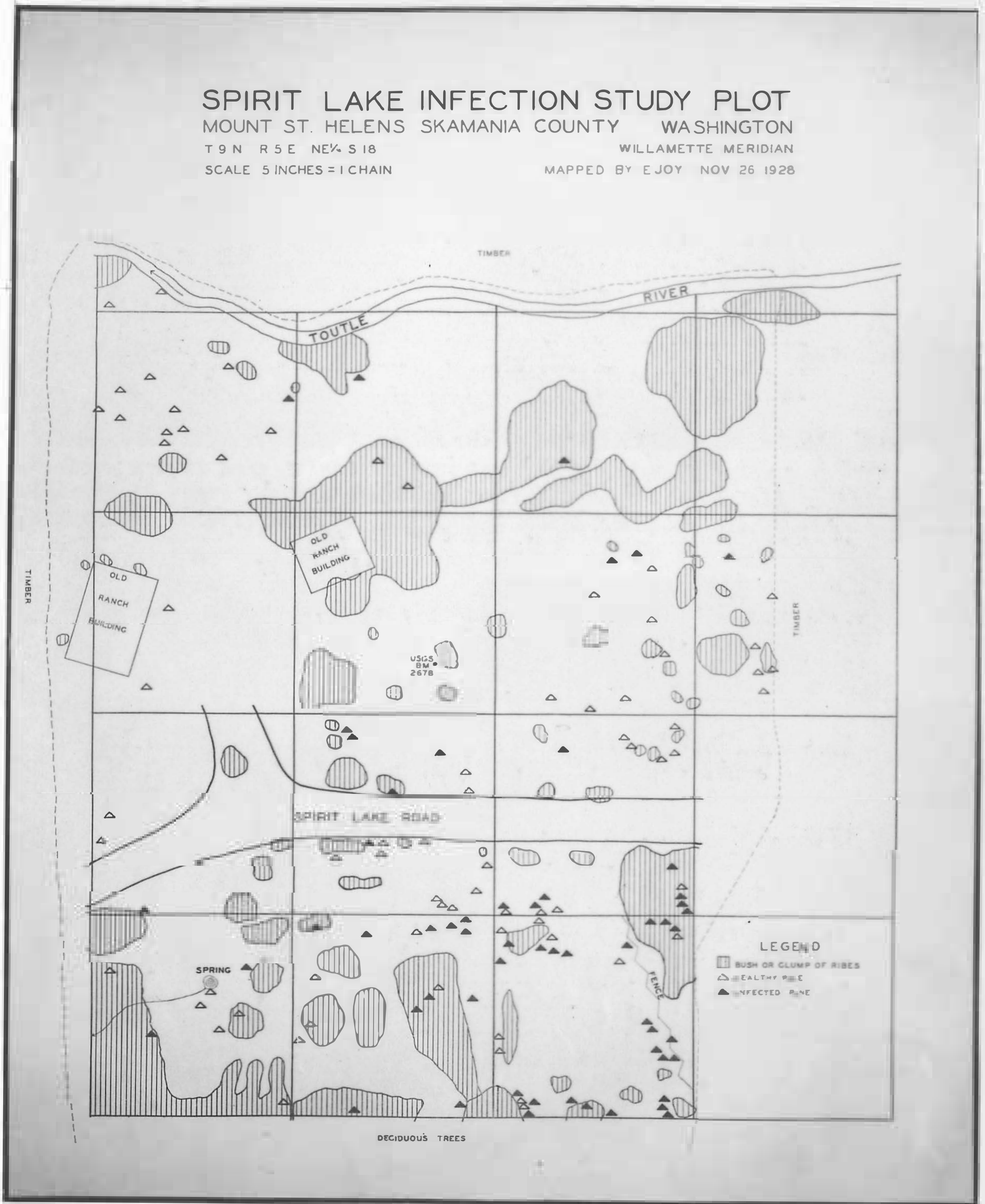
Only 45% of the 57 infected trees found were studied from the standpoint of killing cankers. The basis is too small for any definite conclusions, nevertheless it is indicated that on a comparatively young infection area, the per cent of infected trees possessing killing cankers would be highest in the small trees and decrease in the taller height classes.

In Table No. 8 is shown the per cent of killing cankers classified by height classes of the infected pines.

TABLE NO. 8

CLASSIFICATION OF KILLING AND NON-KILLING CANKERS BY HEIGHT CLASSES OF INFECTED PINES, SPIRIT LAKE, WASH.

Height Classes of Infected Pines	Total Cankers	Killing Cankers			Per Cent of Killing Cankers
		Trunk Cankers	Branch-Trunk Cankers	Branch Cankers	
1 - 5	27	4	1	21	96
5.1 - 10	35	0	0	22	63
10.1 - 15	22	0	0	5	23
15.1 - 20	36	1	0	16	47
20.1 - 25	4	0	0	0	0
Total	124	5	1	64	56



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W. 16. Spirit Lake Infection Plot, Spirit Lake, Washington. On this area, cleared 15 years ago and abandoned, blister rust is abundant on white pines, associated chiefly with R. laxiflorum, which occupies nearly 20% of the area.

W. 20. Young western white pines 1 to 2 feet high, 15 years old growing close together on pumice gravel at 4500 feet elevation, east slope of Mt. St. Helens, Washington, near Spirit Lake Plot.

The same general principle is illustrated in Table No. 8 as was shown in Table No. 7. It is obvious that cankers developing on a small tree must necessarily be situated close to the trunk, since the needles through which entrance is gained are close to the trunk. As the taller height classes are considered, the per cent of cankers which are killing cankers decreases rapidly.

2. Ribes Conditions. In Table No. 9 are shown the Ribes conditions as found on the plot.

TABLE NO. 9

RIBES FOUND ON SPIRIT LAKE PLOT

Ribes Species	Number of Bushes or Clumps	Total Feet Live Stem	% of Total Area Occupied by Ribes Species
R.laxiflorum	70	95,066	19.15%
R. lacustre	16	1,213	.13
R.bracteosum	3	345	.09
R.sanguineum	2	305	.05
Total	91	96,929	19.42

Thus it is apparent that nearly 20% of the ground area was occupied by Ribes growth composed almost entirely of R.laxiflorum.

IV. Infecting Power of R.lacustre and R.viscosissimum

A. Purpose.

The immediate purpose was to find areas suitable for the study of the infecting power of R.lacustre and R.viscosissimum, to determine the amount of such Ribes species it is possible to leave on an area and expect the minimum amount of pine damage, and to determine the distance of spread from such Ribes to pines.

B. Method of Work.

The method used to accomplish this purpose was in the nature of a search for suitable areas. Putnam and Joy spent three weeks in July looking for the right conditions on the east slopes of the northern Cascades of Washington.

C. Results.

Suitable areas were found for this study, one up the Chiwawa River northwest of Wenatchee at Willow Creek, and another near Stevens Pass. Since it would be necessary to make inoculations of Ribes species

with aecia, this information was turned over to the Office of Forest Pathology. Mr. J. L. Meilke of that office was shown the areas in October.

V. Newman Lake Plot

At Newman Lake last spring pine infection was found, obviously caused by rust on quantities of Grossularia inermis. It is contemplated that next spring the G. inermis bushes will be removed, and a plot established there to study the effect of R. lacustre and R. viscosissimum in causing spread of infection to pines.

In preparation for such a study a large scale base map of the immediate region was made this fall. Topography, stream type and white pine limits were shown.

VI. Costs

The costs of these related field studies on damage to pines are considered together, since it would be very difficult to separate them accurately, and the segregated costs would be of little added value.

Table No. 10 gives the costs of this project.

TABLE NO. 10

COSTS OF DAMAGE TO PINE PROJECT

Item	Amount
Salaries	$1,890.84
Subsistence	500.20
Travel	585.40
Equipment	53.93
Miscellaneous	13.43
Total	$3,043.80

The "Travel" item is high because of the necessity of visiting various plots on the coast.

VII. Summary and Conclusions

The conclusions thus far reached on these studies are summarized below:

A. Under conditions of high relative humidity as exist at Cheekye, B. C., a protective zone of 900 feet or even 1,250 feet does not constitute a sufficiently wide strip to protect pines from blister rust.

B. Based on number of cankers per 1,000 feet of pine foliage, Pinus strobus seems to be only half as susceptible as P.monticola growing under western conditions.

C. Based on the findings at the Spirit Lake plot the per cent of infected trees having killing cankers is highest in the small trees and decreases in the trees of taller height classes.

Pre-eradication Survey of the Mountaineers' Club Pine Stand, near Chico, Kitsap Co., Wash.

In the vicinity of the Mountaineers' pine stand near Chico, Washington, there is an abundance of pine infection. Near Paschall's Ranch, and at numerous points on Wild Cat, Lost, and Chico Creeks pine infection is severe. From 75% to 100% of the trees are infected, and damage is beginning to be apparent. On the Mountaineers' pine stand, which is approximately 1/4 mile from Chico Creek, and 200 feet above it, pine infection is much less severe. Here only 2% of the pines show infection at the present time, but undoubtedly if Ribes conditions remain undisturbed, a much higher per cent of pine infection will result.

The Ribes in this locality are chiefly confined to Wild Cat, Lost, Chico and Dickerson Creeks. Along these streams large masses of Ribes bracteosum occur. This species is the most susceptible of the native Ribes on the coast, and is probably capable of causing pine infection for a radius of a mile. Associated with R.bracteosum on the larger streams are other Ribes species of less relative susceptibility.

On the uplands and smaller streams Ribes are very scarce. Occasionally scattered through the stand are R.sanguineum, Grossularia divaricata and R.lacustre. These Ribes species are important sources of pine infecting spores because of their occurrence in the immediate proximity of white pines.

During the latter part of March, 1928 a pre-eradication study was made of this area. The area was surveyed by traversing all streams with topographic chain, Abney level, and standard compass. Contours were drawn in. The area was divided up into the different eradication classes.

Table No. 11 gives an estimate of the cost, based on experience in other localities of protecting the Mountaineers' pine area from blister rust. This estimate includes the eradication of Ribes from the pine stand; from a protective strip 900 feet in width around the stand; and the eradication of R.bracteosum for a mile from the plot along Wild Cat, Lost, Dickerson and Chico Creeks.

TABLE NO. 11

ESTIMATE OF COSTS OF PROTECTING MOUNTAINEERS' PINE AREA, CHICO, USING CHEMICAL ERADICATION METHODS

Type of Eradication	Number of Acres	Estimated Cost per Acre	Total Cost
Hand Pulling, Men Spaced 25 to 65 Feet Apart	195	$1.00	$195.00
Hand Pulling, Men Spaced 8 to 25 Feet Apart	104	3.00	312.00
Stream Type, Hand Pulling, Men Spaced 6 to 8 Ft. Apart	16	20.00	320.00
Stream Type, Chemical Eradication	21	40.00	840.00
Totals and Averages	336	$4.96	$1,667.00

The Mountaineers' Club was interested in the protection of their pine stand. The State Forester expressed a willingness to contribute towards the cost. The Federal Government was willing to stand the major portion of the cost, because of the opportunity to study the effectiveness of control.

Upon the completion of the pre-eradication study, it was decided to abandon the project, owing to the extremely high cost of protecting the area.

The costs of this pre-eradication study are shown in Table No. 12.

TABLE NO. 12

COSTS OF PRE-ERADICATION STUDY, MOUNTAINEERS' PINE PLOT, CHICO, WASHINGTON, MARCH AND APRIL, 1928

Item	Amount
Salaries	$306.26
Expenses	251.36
Total	$557.62

The costs were high because permanent office personnel were used, whose average salary rate was higher than ordinarily paid for work of this nature. Expenses were high because of the necessity of transporting the men from Spokane to the coast.

Spokane, Wn. 12/29/28
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EDUCATIONAL REPORT

by

R. L. MacLeod

Agent

I. Introduction

The educational project holds an important place in the work of the Western Office of Blister Rust Control. It consists in the dissemination of information on the progress and development of blister rust control to blister rust workers, Forest Service personnel, timber protective associations, lumbermen, educational institutions and the general public.

An important phase of the work is the supplying of information to blister rust workers. It is imperative that the personnel of each of the several projects should understand the problems and aims of the other projects in order that they may not lose sight of the common end toward which all work is directed viz., the control of white pine blister rust. A comprehensive view of the relation of the projects can be obtained only with up-to-date information on the progress and results of the work of the other projects. It is one function of educational work to supply this information.

A second function of educational work is the dissemination of information to the owners and administrators of timber lands. To the Forest Service and the private timber owners must be brought a realization of the menace to the forests of the West which blister rust constitutes and the necessity of cooperative action in preserving and perpetuating their tremendous timber assets, both actual and potential. This can be done only by supplying complete information on the history and spread of blister rust, the damage which it has done and can do and the practicability of applying control measures at a reasonable cost.

Educational work must also be carried on among those who, although not immediately concerned with the development of blister rust work, are directly concerned in the economic consequences of control. Schools and colleges must be supplied with specimens and reliable information so that a large number of students may become well informed on the disease. The general public too must be given some knowledge of blister rust and the progress and value of the efforts to control it, in order to build up an active interest in and support of the control program.

II. Purpose of the Project

The purpose of the educational project is to bring to the various classes outlined above a comprehensive view of blister rust and its control, through all available means of publicity.

Until 1928 the work has suffered from the fact that the project leader has had at least one and sometimes two other projects to supervise. Consequently it was impossible to give to this work the attention which it required. Yet in spite of this fact a good foundation for the work has been laid and the situation as regards blister rust is becoming generally better understood.

With the appointment of a full time project leader in July of this year and of a permanent assistant in October, plans have been formulated and are being carried out which should result in adequate attention to the dissemination of information concerning the cause and control of blister rust.

III. Summary of Work

A. Western News Letter

For the dissemination of news to blister rust workers the Western News Letter, as initiated in 1926, has been continued. Seventy-five copies averaging ten pages in length have been issued each month, containing preliminary reports, developments and results of the work in various projects and news of general interest. As the news letter is of a confidential nature an effort has been made to make it a forum for the discussion of any topic on which there may not be full agreement. While the material for the news letter deals for the most part with blister rust topics, associated forestry subjects are sometimes treated. Articles have been submitted by practically all of the permanent personnel of the office.

During the summer months the news letter was enlarged and the mailing list expanded to include temporary employees. This required an issue of 300 copies which averaged 20 pages in length. The purpose of this news letter was to bring to the temporary men some knowledge of the origin and history of blister rust, the seriousness of its menace and the importance and practicability of control methods. These news letters were made as interesting as possible. The impressions of the men were given in prose and poetry. Interspersed with these contributions in lighter vein were articles on blister rust showing the development in the various phases of the work.

B. Personnel Conferences

A meeting of the personnel of the Spokane office was held once a month throughout the year and an annual conference of all western blister rust personnel took place in the Spokane office, February 7-10, 1928.

While it is not, strictly speaking, a function of the educational department to arrange these conferences, they conform to the general policy of keeping blister rust workers informed of developments in the projects and in the control program. They are educational in effect.

At each regular monthly meeting of the personnel of the Spokane office, a paper was read by one of the members on some blister rust topic. Following a discussion of this paper other points concerning blister rust activities or office procedure were brought up and discussed. It is felt that these meetings have been well worth while.

The annual personnel conference in February brought together all blister rust workers of the Western Office of Blister Rust Control and of the Office of Forest Pathology, Portland, Oregon. A paper dealing with each of the several projects was read and many important points brought out in the subsequent discussion. Such a conference gives each one a better knowledge of the component projects of the blister rust work and a realization of the inter-relation of those projects. While it may result in no immediate action, the interchange of views must have a definite value in forwarding the cause of blister rust control.

C. Talks and Papers

The following tabulation of talks and papers by various members of the personnel gives some idea of the scope of this type of educational work:

The White Pine Blister Rust Problem - C. R. Stillinger.
Lantern slide talk before Kloneson Club, Spokane, Washington, January 11, 1928 and before the South Side Garden Club, Spokane, Washington, January 12, 1928.

Blister Rust Control - S. N. Wyckoff.
Presented to Forest Service Investigative Meeting, District No.1, January 14, 1928.

The Blister Rust Situation in the West - Dr. E. E. Hubert.
Presented to Western Forestry and Conservation Association, Tacoma, Washington, February 21, 1928.

Blister Rust Control Reconnaissance in California - E. C. Kenyon. March 3, 1928. To be published in California State Department Monthly Bulletin.

The Application of Blister Rust Control in the Inland Empire - C.C. Strong. Presented to the Northern Rocky Mountain Section, Society of American Foresters, Moscow, Idaho, March 10, 1928.

Management of White Pine Areas in Relation to Blister Rust Control - Dr. E. E. Hubert. Presented to the Northern Rocky Mountain Section, Society of American Foresters, Moscow, Idaho, March 10, 1028.

The Work the Office of Blister Rust Control is Doing to Protect our Forests - S. N. Wyckoff. Published in Spokane newspaper during American Forest Week, April 23, 1928.

An Outlaw of the Pacific Slope or How a Common Garden Bush is a Menace to Some Forest Trees - G. A. Root. Radio talk over Station KGO San Francisco during American Forest Week. April 25, 1928.

White Pine Blister Rust In Inland Empire - C. R. Stillinger. April 27, 1928. For publication in "Northwest Science".

White Pine Blister Rust - R. L. MacLeod. Radio talk over Station KGA Spokane, Washington, April 28, 1928, during the American Forest Week.

White Pine Blister Rust - L. N. Goodding. Presented to Western Plant Quarantine Board Meeting, July 12-14, 1928.

The Chemical Eradication of Ribes - H. R. Offord. For publication in Department Bulletin.

Relation of Forest Management to the Control of White Pine Blister Rust - Dr. E. E. Hubert. Published in Journal of Forestry, November 1928.

Report on Blister Rust Control - S. N. Wyckoff. Presented to meeting of Trustees of the Western White Pine Blister Rust Conference, Portland, Oregon, December 7, 1928.

Known Extent of Blister Rust Infection in the Inland Empire at the Close of the 1928 Field Season - H. N. Putnam. Presented to Northwest Scientific Association at Spokane, Washington, December 28, 1928.

Ribes Ecology - W. A. Rockie. Lantern slide talk delivered to Northwest Scientific Association at Spokane, Washington, December 28, 1928.

D. Educational Work in Individual States

Educational work in Montana, Oregon and California is carried on by the state leader for each state as each state leader has a specialized knowledge of conditions obtaining in his state and its educational requirements. Bulletins, specimens of blister rust, displays and other demonstration material are supplied from the Spokane office and used as the state leader sees fit. The policy has been adopted of referring all requests for blister rust material from any of these states to the state leader concerned. The educational work carried on by the state leaders is treated in the reports for their respective states.

E. Blister rust specimens

It has been recognized that a subject such as white pine blister rust, complex in its details, can not be described adequately without the aid of actual specimens of the disease. On this account an effort has been made to develop to a greater extent this important aspect of educational work. A supply of uredinial, telial and aecial specimens was gathered in British Columbia and on the Olympic Peninsula in Washington.

As in the past each uredinial and telial specimen was mounted on a 4"x6" piece of cardboard covered with a layer of cotton wool. A celluloid covering was placed over the specimen and legend, rivetted to the cardboard and the edges sealed with black tape. Aecial specimens were sealed in a pickling solution in individual test tubes.

Two hundred fifty mounts of both uredinial and telial specimens and 150 tubes of aecial material were made up. Ten of each were sent to Forest Service officials, 35 of each to educational institutions while 90 of each stage on Ribes and 70 aecial specimens were supplied to state and project leaders. The remainder have been kept on hand to be sent out as requested. A much greater supply than has heretofore been gathered will be procured in the spring of 1929.

F. Demonstration Boxes

a. 3-specimen box. A small demonstration box, $1\frac{3}{4}$"x$6\frac{1}{2}$"x9" outside measurements, was developed to show the life-cycle of blister rust. This box contains one aecial specimen and two currant leaves showing the stages on Ribes. Suitable legends supplemented with arrows describe the life cycle of the disease. In the lid of the box is placed a bulletin describing the various blister rust activities; when used for display purposes this bulletin is replaced by a photograph showing blister rust on white pine.

This box was designed for the use of state and project leaders, Forest Service officials, state inspectors and blister rust workers who were likely to come in contact with the public.

During the spring of the year 45 of these boxes were made up. Of these 20 were sent to state leaders, 10 to Forest Service officials, 7 to state inspectors, while 7 were used by blister rust workers.

After the field season was completed an additional 75 of these boxes were made up, of which 20 were supplied to state leaders.

b. 7-specimen box. Early in the summer a demonstration box was developed showing the several stages of blister rust on pine, viz., first symptoms, juvenile, pycnial scars, first fruiting and second fruiting. Four of these boxes were made up, three of which proved useful to the scouting project in training crews who were not thoroughly familiar with the various stages of the disease and in explaining blister rust to the public.

In the fall of the year this demonstration box was improved. To the five tubes showing the stages on pine were added two currant leaves showing the stages on Ribes, thus showing a comprehensive blister rust life cycle. A complete legend describing each stage in the life cycle was placed in the lid of the box.

Owing to a scarcity of specimens showing the early stages of the disease on pine, only 12 of these boxes were made up. One box was sent to each of the following: L. N. Goodding, Oregon State Leader; C. H. Johnson, Montana State Leader; Dr. E. E. Hubert, Collaborator; H. R. Offord, Chemical Investigative Project; G. A. Root, California State Leader; R. H. Weidman, Director Northern Rocky Mountain Experiment Station; Department of Plant Pathology, University of Idaho; Department of Forestry, Utah Agricultural College and the Washington Office of Blister Rust Control.

In the spring of 1929 an adequate supply of specimens showing well defined stages of the disease on pine will be gathered to insure the development of a sufficient number of these boxes for all purposes.

G. Photography

Photography plays an important part in the work of the educational project. Besides serving as a permanent record of various phases of

the work, good pictures are prerequisite to the making of lantern slides, to effective display work and to the making of cuts for newspapers. It is a generally recognized fact that visual education is more effective than any other form. It is difficult for anyone not connected with the blister rust work to grasp its full significance without some visual representation to aid the understanding and memory. Illustrated with pictures or slides the details of a talk or paper are much more readily comprehensible.

Photographic work falls into two divisions: 1, field pictures 2, office or indoor pictures. Field work consists in the photographic recording of the work of the various projects and of all other outdoor subjects connected with blister rust. In the office the camera is used for copy work. Photographs are taken of maps, charts and tables which require reduction for the annual report or for any other purpose.

In the spring of 1928 the project was supplied with a 5x7 camera with supplementary filters and magnifying and wide angle lenses. In the fall of 1928 an 8x10 camera box and a suitable stand were procured for copy work. The lens from the 5x7 camera gives satisfaction when used with the 8x10 camera box. The project is now supplied with adequate equipment for satisfactory photographic work.

During the field season 135 photographs were added to the files under the following heads: hand eradication - 40, chemical eradication - 28, ecology - 31, plot studies of damage to pine - 14, scouting - 6, Ribes - 5, western white pine - 8, sugar pine - 3.

From the pictures on file an adequate number of lantern slides to illustrate all divisions of blister rust work were made. A number of duplicates were made in order that the state leaders might have a supply on hand at all times. One hundred seventy of these slides are now in their possession.

H. Newspaper Articles

Articles on blister rust subjects were run in newspapers in Spokane, Washington, Priest River, Wallace and Orofino, Idaho, and Missoula and Helena, Montana. Information was supplied to Mr. Gilbert Parker for an article "Federal and State Agencies Join Forces to Keep California Free From White Pine Blister Rust" in the "American Trust Review of the Pacific".

This phase of educational work should receive more attention as it assists in bringing to the public a realization of the menace of

blister rust and some understanding of control work. Cuts of some of the best pictures were procured in the fall of the year so that future newspaper articles should be more effective with this illustrative aid.

I. Demonstration Work

A blister rust demonstration was shown at the Sportmen's and Tourists' Fair in Spokane, Washington, May 14-19, 1928. Diseased specimens of both hosts, mounts showing the life cycle, damage and control pictures and actual specimens of white pine and several species of Ribes were shown, supplemented with lantern slides.

Letters were written to the county agents at Bonners Ferry, Sandpoint, Coeur d'Alene and Orofino, Idaho concerning the placing of a blister rust demonstration in the county fairs usually held at these centers. However, no county fairs were held at these points during 1928.

As further work has been done in preparing mounts for blister rust demonstrations, state and county fairs can be covered adequately when held in the future.

IV. Recommendations

From a study of the requirements of the educational project in planning future work the following recommendations are made:

1. That an automatic slide projector be provided. This type of projector has important advantages over the present equipment and would greatly facilitate demonstration work.

2. That albums showing the several divisions of blister rust work be prepared for timber protective associations, lumbermen, Forest Service offices and blister rust camps.

3. That bulletins giving up-to-date information on history and spread of blister rust, Ribes ecology and eradication be prepared. As the bulletins on hand are general in nature it is imperative that supplementary bulletins giving more specific data be prepared.

4. That a bulletin for a mailing list of oursiders not connected with the work but interested in blister rust be prepared twice a year. The news letter has a closed circulation and is of a confidential nature. A bulletin for outsiders would contain information which is not confidential. It should summarize developments in the spread of blister rust and progress in control work.

5. That material for fair work and other demonstrations be prepared or revised and improved.

6. That demonstrations supplemented with lantern slides be prepared for Forest Service schools and for county fairs of North Idaho.

7. That definite sets of bulletins and pictures be prepared in order to fill requests for blister rust data, such as are received from students writing theses on blister rust.

8. That sets of slides be developed for blister rust talks.

9. That an adequate number of both types of demonstration boxes be made up to supply all blister rust camps, forest supervisors, timber protective associations and schools of forestry in the economic region of which the white pine belt forms a part.

10. That sets of questions and answers covering the important phases of blister rust activity be prepared.

11. That specimens of diseased Ribes leaves be gathered, pickled and supplied for microscopic examination in college courses on blister rust.

EXPENDITURES
By
WESTERN OFFICE OF BLISTER RUST CONTROL
Calendar year 1928.

The two tabulations, "Federal Expenditures", January 1, 1928-June 30, 1928 and July 1, 1928-December 31, 1928, give a summary of Federal expenditures for the respective periods by projects.

For control, comparative and statistical purposes, the expenditures by projects have been divided to show purpose, as, salaries and expense, the latter being itemized by subsistence; R. R., Pullman, stage, etc., personal auto; rental and operation of autos; operation of Government trucks; express, freight and drayage; supplies and equipment; and miscellaneous.

While it has not been shown here, the office records show the classification of all expenditures by object, such classification being available for such uses as arise.

FEDERAL EXPENDITURES
WESTERN OFFICE OF BLISTER RUST CONTROL
January 1, 1928-June 30, 1928.

	PROJECTS	Salaries	Expenses	Total	Subsistence Expenses	R.R. Pullman, Stage etc	Autos Personal	Autos [illegible]		Operation Gov't. Ford Trucks	Express Freight Drayage	Supplies and Equipment	Miscl. Expenses
1.1	Cultivated black currant location and eradication in cooperation with states												
	1.11 - Montana	$150.00	-	[illegible]	-	-	-	-	-	-	-	-	-
	1.13 - Washington	45.00	-	45.00	-	-	-	-	-	-	-	-	-
	1.15 - California	943.65	$667.49	[illegible]	[illegible]	[illegible]	$186.34	-	-	-	$ .90	$3.30	$ .45
1.2	Inspection of transported host plants in cooperation with the Federal Horticultural Board	3,882.50	2,368.6[illegible]	6,251.14	1,855.71	392.03	114.54	-	-	$3.02	2.19	.70	.45
1.3	[illegible]												
	[illegible]	908.16	213.76	[illegible]	[illegible].70	57.69	85.40	-	-	-	4.13	6.34	1.50
[illegible]	[illegible]	3,124.14	1,386.8[illegible]	4,510.99	433.83	507.17	36.19	-	-	60.74	20.31	305.48	23.13
[illegible]	[illegible]												
	2.42 - Idaho	3,398.67	1,383.84	4,782.51	382.56	134.10	316.47	-	-	4.83	1.65	520.33	23.90
	2.44 - Oregon	207.50	99.39	306.89	64.42	-	29.89	-	-	-	1.00	4.08	-
	2.45 - California	790.00	413.60	1,203.60	260.16	54.83	-	-	-	61.14	6.61	23.50	7.36
3.0	Application of chemical eradication												
	3.02 - Idaho	1,442.60	4,990.18	6,432.78	819.30	95.06	49.07	-	-	45.12	# 1,389.49	2,531.54	62.60
3.1	Control Reconnaissance on Federal lands												
	3.11 - Montana	1,282.48	435.42	1,717.90	168.48	38.36	175.14	-	-	-	.85	45.69	6.90
	3.12 - Idaho	2,510.14	747.29	3,257.43	314.00	-	-	-	-	53.64	7.78	341.47	30.40
	3.15 - California	2,328.31	853.13	3,181.44	577.92	8.64	139.16	-	-	21.51	27.18	43.90	34.82
3.2	Ribes eradication on Federal lands												
	3.21-c - Montana (by chemicals)	230.90	1,432.05	1,662.95	162.91	20.76	-	-	-	-	180.61	1,067.37	.40
	3.21-h - Montana (by hand)	319.34	183.72	503.06	161.27	-	-	-	-	-	3.09	19.22	.14
	3.22 - Idaho	5,058.99	2,258.88	7,317.87	1,028.64	8.21	35.35	-	-	12.38	* 307.64	794.95	71.71
	3.23 - Washington	694.30	521.17	1,215.47	252.43	42.93	163.03	-	-	-	16.82	44.96	1.00
	3.24 - Oregon	-	1.25	1.25	-	-	-	-	-	-	1.25	-	-
	3.25 - California	3,496.21	1,610.92	5,107.13	1,026.58	128.96	204.75	-	-	14.07	52.83	84.85	98.88
3.3	Control demonstration on private lands												
	3.32 - Idaho	2,189.22	644.27	2,833.49	208.33	16.19	33.46	-	-	21.39	31.37	317.63	15.90
3.4	Cooperative Ribes eradication												
	3.42 - Idaho **	1,171.79	342.01	** 1,513.80	206.23	-	13.86	-	-	3.25	-	77.15	41.52
	3.43 - Washington	306.26	251.36	557.62	126.10	82.75	41.86	-	-	-	-	-	.65
4.1	Spread of the rust												
	4.11 - Montana	-	2.35	2.35	-	-	-	-	-	-	-	2.35	-
	4.12 - Idaho	457.50	292.25	749.75	200.50	-	78.33	-	-	-	-	5.80	7.62
	4.13 - Washington	1,387.50	304.34	1,691.84	117.95	17.75	87.50	-	-	51.99	.50	6.20	22.45
	4.14 - Oregon	-	2.35	2.35	-	-	-	-	-	-	-	2.35	-
	4.15 - California	-	2.35	2.35	-	-	-	-	-	-	-	2.35	-
	4.16 - British Columbia	-	2.35	2.35	-	-	-	-	-	-	-	2.35	-
4.2	Damage to Pine	711.50	588.63	1,300.13	271.80	256.26	45.15	-	-	5.14	-	8.78	1.50
6.	Educational work												
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	-	-	-	[illegible]	-	-
	[illegible]	[illegible]	-	[illegible]	-	-	-	-	-	-	-	-	-
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	-	[illegible]	[illegible]	[illegible]
	[illegible]		[illegible]	[illegible]	-	-	-	-	-	-	[illegible]	[illegible]	-
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	-	-	-	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	-	-	-	-	-	[illegible]
[illegible]	[illegible]	-	[illegible]	[illegible]	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	-	[illegible]	[illegible]	-	-	-	-	-	-	[illegible]	[illegible]	-
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	[illegible]	[illegible]	[illegible]	[illegible]

#Includes pack string hire.
*Includes operation of G.M. C. truck, and pack string hire.
**June voucher covering subsistence supplies in the amount of $263.39 and other supplies in the amount of $6.15, total $270.24, paid by the State of Idaho, in addition to these expenditures made by the Federal Government.

Annual Report 1928,
M. L. McWold.

FEDERAL EXPENDITURES
WESTERN OFFICE OF BLISTER RUST CONTROL
July 1, 1928-December 31, 1928

	PROJECTS	Salaries	Expenses	Total	Subsistence Expenses	R. R. Pullman, Stage, etc.	Autos Personal	Autos Rental	Autos Operation	Operation Gov't. Ford Trucks	Express Freight Drayage	Supplies and Equipment	Miscl. Expenses
1.1	Cultivated black currant location and eradication in cooperation with states												
	1.11 - Montana	[illegible]	-	[illegible]	-	-	-	-	-	-	-	-	-
	1.1[illegible] - [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	-	$ 16.35	[illegible].50
	1.1[illegible] - California	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	[illegible] 5.30	13.35	6.16
1.3	Sanitation of nurseries												
	1.34 - [illegible]re[illegible]on	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	[illegible]	[illegible]	-	-	6.33	.29
2.3	Testing and improving chemical destruction of Rib[illegible]s	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	[illegible] 94.03	64.79	409.[illegible]7	86.66
2.4	Ecological studies												
	2.42 - [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	73[illegible].97	-	-	11.30	[illegible]	143.19	8.30
	2.44 - [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	442.[illegible]6	[illegible].00	-	-	[illegible]7	30.52	.50
	2.45 - [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	101.33	14.10	107.8[illegible]	2[illegible].88
3.0	Application of chemical eradication												
	3.02 - [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]30.5[illegible]	-	-	197.95	[illegible]	[illegible]	358.82
3.1	Control reconnaissance on Federal lands												
	3.11 - [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	124.46	-	-	-	-	32.89	-
	3.12 - Idah[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	98.84	1[illegible].32	65.62	17.93
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	129.78	-	-	39.03	15.00	819.63	36.91
3.2	[illegible]												
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	[illegible]	2,539.85	21.82
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	-	[illegible].67	35.65	-
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	[illegible]	[illegible]	[illegible]6.80	96.7[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	-	27.03	-
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	[illegible]	132.86	6.09
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	[illegible]	[illegible]	973.83	46.18
3.3	Control demonstrations on private lands												
	3.32 - [illegible]dah[illegible]	3,112.66	554.79	3,667.45	299.10	4.79	119.21	-	-	9.32	75.34	47.03	-
3.4	Cooperative Ribes eradication												
	3.42 - Idaho **	1,514.94	1,778.91	3,293.85 **	1,476.[illegible]	-	86.24	-	-	-	5.93	208.81	1.64
4.1	Spread of the rust												
	4.11 - Montana	635.55	495.43	1,130.98	188.65	12.86	285.67	-	-	-	-	8.25	-
	4.12 - Idaho	2,705.83	1,624.81	4,330.64	963.31	10.61	61[illegible].53	-	-	-	1.80	17.45	17.11
	4.13 - Washington	-	16.08	16.08	-	-	-	-	-	-	-	16.08	-
	4.14 - Oregon	511.66	1,198.30	1,709.96	551.13	92.09	461.30	56.[illegible]	9.67	-	3.00	10.51	14.50
	4.15 - California	-	8.00	8.00	-	-	-	-	-	-	-	8.00	-
	4.16 - British Columbia	80.[illegible]	[illegible]66	185.00	52.[illegible]	5.00	38.71	-	-	-	-	8.00	-
4.2	Damage to Pine	732.20	535.19	1,267.39	[illegible]8.40	32.25	235.69	5.00	-	5.91	-	15.40	2.54
6.	Educational Work												
	6.0 - Spokane Office	1,125.00	796.45	1,921.45	95.65	82.11	156.80	-	-	6.75	7.78	211.27	236.09
	6.1 - Montana	270.00	-	270.00	-	-	-	-	-	-	-	-	-
	6.4 - Oregon	-	39.66	39.66	-	-	-	-	-	-	1.15	7.87	30.64
	6.5 - California	318.33	57.52	375.8[illegible]	18.6[illegible]	32.00	-	-	-	-	2.42	4.45	-
9.1	Supervision	2,299.98	739.36	3,039.34	196.54	540.79	-	-	-	-	-	-	2.03
9.2	Maintenance of field office	6,591.69	1,880.38	8,472.07	32.95	101.9[illegible]	-	-	-	-	-	-	1,745.48
9.3	Miscellaneous supplies, etc., paid on L/A	-	341.02	341.02	-	-	-	-	-	22.33	65.62	194.23	58.84
9.4	Supplies, freight and express, paid in Washington, D. C. ##	-	600.88	600.88 ##	-	-	-	-	-	-	10.52	588.86	1.50
	Total	$81,957.89	$47,060.57	$129,018.46	$19,707.24	$2,336.31	$[illegible],094.13	[illegible]131.5[illegible]	$19.38	$716.78	$2,762.96	$12,469.02	$2,823.22

*Includes pack string hire for this project and operation G.M.C. truck for this project and projects 3.02 and 3.42. In determining eradication costs the cost of operation of the truck is to be prorated to these three projects according to the number of trips made for each.

#Includes pack string hire and miscellaneous pack horse hire.

**See also the separate summary of State and Priest Lake Timber Protective Association expenditures for the project.

##Stationery and other office supplies and freight on same in the total amount of $268.16 have been furnished this office from Washington, D. C., the cost of which is allocated to the "General Control Program" and is not included in the total for this project.

Annual Report 1928,
M. L. McWold.

The following is a summary of funds expended on cooperative Ribes eradication by the Priest Lake Timber Protective Association and the State of Idaho.

The Association funds were deposited in the U. S. Treasury and expended by the Western Office of Blister Rust Control while the State disbursed its own funds, the vouchers being submitted for payment by the Western Office of Blister Rust Control.

SUMMARY OF
*BLISTER RUST CONTROL COOPERATIVE RIBES ERADICATION EXPENDITURES
BY THE
STATE OF IDAHO AND PRIEST LAKE TIMBER PROTECTIVE ASSOCIATION
JUNE 15, 1928 - SEPTEMBER 20, 1928

Cooperating Agency	Salary	Expense	Total	Subsistence Supplies	Miscellaneous Supplies
State of Idaho	$1,711.73	$806.82	$2,518.55	$792.17	$14.65
Priest Lake Timber Protective Association	2,220.33	43.99	2,264.32	42.19	1.80
Total	$3,932.06	$850.81	$4,782.87	$834.36	$16.45

*For Federal expenditures on this project see project 3.42, on statements of Federal Blister Rust Control expenditures, January 1, 1928 to June 30, 1928 and July 1, 1928 to December 31, 1928.

GENERAL SUMMARY

I. The Delay Program

A. Spread of the Rust

1. Scouting for New Infection. During the past year scouting was carried on in western and northeastern Washington, northern Idaho, northwestern Montana, western Oregon and northwestern California.

a. New Pine Infections: (1) Spokane County, Washington, near Newman Lake. (2) Multnomah County, Oregon, near Palmer. (3) Clackamas County, Oregon near Rhododendron.

b. New Ribes Infections: (1) On *Ribes petiolare* and *Grossularia inermis*, more or less generally distributed from Pierce, Clearwater County, Idaho, north to the International Boundary, with concentrations of infection found in Clearwater County near Elk River, Idaho, and in Latah County near Clarkia, Idaho. (2) New infections found in Multnomah, Clackamas, Lincoln, Benton, Tillamook, Yamhill, Polk, Washington and Marion counties in Oregon. (3) New infections in Lincoln County, Montana, near Bull Lake. (4) Extension of infection into Chelan County on the east slope of the Cascades in Washington.

B. Cultivated Black Currant Eradication

1. California. 198 black currant plantings, numbering 1806 bushes, were eradicated from 9 counties during 1928. At the present time 49 counties have been eradicated of 5,727 cultivated black currant bushes.

2. Washington. A survey of the cultivated black currant situation in western Washington indicates an average of 4.35 bushes per thousand population in the urban districts and an average of 5.45 bushes per thousand population in the rural districts. This results in an estimated total of 21,663 black currant bushes in western Washington.

C. Maintenance of Blister Rust Quarantine.

The quarantines regulating the movement of blister rust host plants have been effectively maintained. Inspection of 44,314 shipments of transient nursery stock (shipped via freight, express and parcel post) resulted in the interception of 55 violations of Federal quarantine 63. Results are shown only for inspection work under the Office of Blister Rust Control up to July 1, 1928. From this date, this phase of the work was conducted by the Office of Plant Quarantine and Control Administration.

II. Development and Demonstration of Local Control

A. Hand Eradication of Ribes

Development of experimental local control was carried forward with results as follows:

1. Idaho: On the Coeur d'Alene National Forest 777,850 Ribes were eradicated from 9,340.3 acres of white pine type or 83.3 Ribes per acre at an average cost of $1.65 per acre. On the Priest Lake Timber Protective Association (cooperative project) 577,945 Ribes were eradicated from 8,457 acres of white pine type or 68 Ribes per acre at an average cost of $1.08 per acre.

2. Oregon: a. 9,237 Ribes (an average of 20.1 per acre) were eradicated from 458.3 acres of the Still Creek Planting Area, Mt. Hood National Forest.

b. A protective zone was established around the Wind River Forest Nursery, Columbia National Forest. This zone, embodying approximately 2,157 acres, included all the area within a radius of one mile from the nursery. 13,474 Ribes were eradicated from the area, an average of 6.1 Ribes per acre.

3. California. On the Stanislaus National Forest, 268,202 Ribes, averaging 31 Ribes per acre, were eradicated from 8,558.5 acres of sugar pine type at an average cost of $1.00 per acre.

B. Re-eradication of Areas Eradicated 1926.

1. Studies conducted in the Kaniksu National Forest, Idaho, the past year show:

a. 5.7 bushes per acre found by checkers, "missed" by 1926 eradication crews.

b. 6.9 bushes per acre average, were sprouts from partially pulled bushes and seedlings under 6 inches in height.

c. Estimated cost of re-eradication on areas needed to be re-eradicated, $0.51 per acre.

d. Sprouts of R. viscosissimum occurred when crowns were left in the ground.

e. Practically no germination of Ribes seeds occurs following eradication in well stocked timber stands.

f. Missed Ribes and sprouts from partially pulled bushes were well distributed over the area and no groups of Ribes were left.

g. The majority of the Ribes missed were suppressed and small in size.

h. Sprouts and seedlings are numerous in stream type following hand eradication.

i. Ribes germination is high on rock slides due to the duff disturbance and the exposure to heat of the sun. Mortality of seedlings is great on these sites.

j. Chemical application is warranted on rock slides.

C. Chemical Eradication of Ribes.

Experiments in methods of eradicating concentrations of Ribes by applying toxic chemical solutions were continued on a large scale. Various types of knapsack and power spraying equipment were employed.

1. At Haugan, Montana, concentrations of Ribes on 476.8 acres of stream type and swamp type were destroyed at an average cost of $20.29 per acre.

2. At Bovill, Idaho, Ribes were destroyed from 537.4 acres of stream type at an average cost of $17.59 per acre.

3. Laboratory and Field Experiments

a. Field experiments at Still Creek, Oregon; 18 spray formulae applied to *R. bracteosum* and *R. lacustre.*

b. Field experiments on the Stanislaus National Forest, California; 75 spray formulae were applied to *R. nevadense.*

c. Field experiments at Santa, Idaho; 99 spray formulae were applied chiefly to *G. inermis* and *R. lacustre.*

d. Experiments on several Ribes species have shown that sodium chlorate is rapidly and evenly distributed throughout the tissue if cut stems are placed in the salt solution. The same holds true if dilute chlorate solutions are added to sand or water cultures on which vigorous and healthy Ribes are growing. When the chemical is sprayed on the aerial parts, however, differences in susceptibility are invariably shown by the several Ribes species.

These data indicate that difference may be due to (1) protective tissues which prevent the chlorate from entering vital groups of cells; (2) plant buffers which are capable of rendering the sodium chlorate inactive and (3) structural differences which allow extensive movement of the chlorate in the case of one species, and keep the chemical effects rather localized in others.

Qualitative chemical analyses of leaves and stems of four Ribes species suggest significant differences in the suberin-cutin and lignin fractions. It was also noted that R. petiolare (most susceptible to sodium chlorate) contained 2-4% tannin while R. lacustre contained 8-12%. The most significant data obtained from early investigations of the tannin content of the various Ribes species are the different reactions of the tannins themselves. The tannins differ markedly in their ability to precipitate other chemicals and suggest a specific buffer effect.

Fundamental studies on the nature of the toxic action of sodium chlorate were made. Nitella was used as the plant material. The results pertinent to these studies are as follows:

1. No physiological "accumulation" of the chlorate ion, as such, occurs within the protoplast.

2. The initial toxic action of the sodium chlorate is confined to the cell wall and possibly the plasma membrane. After the cell wall or plasma membrane has been injured, it then becomes permeable and sodium chlorate is able to diosmose into the protoplast.

3. Both wave length and intensity of light are important governing factors; the latter is probably the more important of the two. The penetration of the chlorate into the protoplast, even after the cell wall has been injured, is considerably curtailed in the absence of light.

4. Sodium chlorate penetrates more rapidly in a pH medium of 5 than in a medium having a pH of 7.

5. Ammonium chloride and ammonium sulphate, on the other hand, "accumulate" within the cell sap.

6. Mixtures of sodium chlorate and calcium chloride are less toxic than sodium chlorate alone. Apparently calcium salts exhibit the well known protective role when added to the chlorate solutions.

7. Addition of ammonium chloride to sodium chlorate provides a more toxic medium than the sodium chlorate alone, and considerably more than the calcium chloride-sodium chlorate mixture.

8. Recommended that sodium chlorate 10% (pH 2) solution be used for the eradication of R. petiolare and sodium chlorate 25% in 1 N. alkaline solution be used for the eradication of G. inermis and R. lacustre.

D. Control Reconnaissance

This work was a continuation of the preliminary survey of western white and sugar pine forests to obtain information on blister rust hosts and general topography and forestry conditions in California, Idaho and Montana. On national forests the acreage covered was as follows: California - 156,573 acres, Idaho - 947,803 acres and Montana - 153,600 acres. On

private lands 351,543 acres were covered in Idaho and 8,960 acres in Montana, making a total of 1,257,976 acres on national forest land and 360,503 acres on private land or a grand total of 1,618,479 acres of western white and sugar pine forests.

E. Ribes Ecological Studies in Idaho. In 1926 definite plans were evolved for research field experiments in Ribes ecology, and in 1927 these controlled field experiments were established. In 1928 these same experiments were in progress and new studies of soil temperature and soil moisture were initiated.

The definite findings to date are as follows:

1. The seeds of *R. lacustre* and *R. viscosissimum* are generally on top of the mineral soil and lie dormant in the soil for long periods.

2. The summer temperature on top of the mineral soil beneath full timber canopy and under a heavy duff mantle has about 2^{o} C. daily range.

3. Without timber canopy and under 1 inch duff mantle the daily range in temperature is about 20^{o} C. Under a 2 inch or thicker duff mantle the daily temperature range is about 3^{o} C.

4. Without timber canopy and without duff mantle the daily range in temperature is about 20^{o} C.

5. After a forest fire has destroyed the canopy and the duff, leaving a blackened surface, the daily temperature range is about 25^{o} C.

6. A severe forest fire kills most of the Ribes seeds stored in the duff.

7. Light or medium forest fires do not usually kill Ribes seeds stored in the duff.

8. Removal of timber canopy and disturbance of the duff are the controlling factors in the renewed activity of the stored Ribes seeds, e.g.- by fire or logging and road or trail construction.

9. Ribes appear abundantly after most fires or logging operations.

10. Ribes seedlings die in large numbers because the moisture content of the top soil frequently goes below the wilting point of the plant.

11. Ribes begin fruiting in their third year, and are generally fruiting abundantly by their 5th year.

12. Ribes may produce more than 25,000 seeds per bush per year, over a period of several years.

13. Ribes usually die before reaching the age of 25 years.

14. Birds and rodents eat Ribes fruits, but the evidence at hand indicates that they are not major agencies in the distribution of Ribes.

15. Horizontal distribution of Ribes seeds is usually negligible, except along water ways.

16. Ribes seeds have been observed to germinate in the field from March to October inclusive.

F. Ribes Ecological Studies in California. This work was initiated in 1928. From data obtained in the one season's work the following tentative conclusions have been made regarding conditions on the Stanislaus National Forest:

1. After a timber stand has been cut the Ribes begin coming in the first year and continue to do so for a number of years. A small amount of seed is produced by the veteran bushes even in well shaded stands. This seed may account for the production of a few plants during the first few years. After the stand has been opened up the remaining veteran bushes take on new life and produce fruits in abundance. Water, gravity and animals are probably instrumental in bringing seeds into stands where there are few Ribes.

2. *G. roezli* begins to fruit very lightly in its third year and continues to fruit as long as sufficient light, moisture and food are available.

3. The lack of sufficient moisture during the growing season accounts for the absence of *G. roezli* on hot dry slopes. *R. nevadense* has a definite moisture requirement, hence it is found only where sufficient moisture is available during the entire year.

4. *R. cereum* and *R. viscosissimum* are not found in sufficient number to constitute a serious problem in this locality.

5. The optimum site for sugar pine appears to be the optimum site for *G. roezli* due to the fact that both Ribes and sugar pine have a definite moisture requirement.

6. *G. roezli* is the most common Ribes on dry slopes. *R. nevadense* is confined to moist slopes and to narrow strips along streams and rivers.

G. Ribes Ecological Studies in Oregon. Results for the past season in southern Oregon are brought out by the following summary:

1. The aerial parts of *R. cereum* are killed by the average heavy burn, but the old stumps send up a mass of vigorous new shoots the following spring.

2. Seeds of *G. klamathensis* do not all germinate during the first

season following eradication, but may germinate each year thereafter.

3. Fruits of six species of Ribes buried for one season did not germinate.

4. Light duff fires resulted in the production of a heavy growth of small annual and perennial plants but no Ribes seedlings.

H. Educational Work

Educational work has consisted in the preparation of blister rust mounts, posters and other demonstration material and the dissemination of information through talks and papers, demonstrations and the supplying of specimens and bulletins to the Forest Service, timber protective associations and educational institutions.

III. Field and Plot Studies of Blister Rust. Damage to Pine.

A. Results obtained from a re-inspection of the Cheekye Plot indicate that a protective strip of 900 feet or even 1250 feet is not sufficient to protect white pine under the moist conditions which obtain at Cheekye.

B. Plot studies of the relative susceptibility of *Pinus monticola* and *P. strobus* indicate that the number of cankers per 1000 feet of needle-stem found on *P. monticola* is three times the number found on *P. strobus*.

C. A plot was established at Spirit Lake, Washington to study rust development in a region representative of the white pine belt in the Cascades of Oregon and Washington. Present results indicate that both the per cent of trees bearing killing cankers and the per cent of cankers produced per tree which are "killing cankers" decrease with increased height classes.

IV. Eradication Methods Studies

A. Hand Pulling Ribes Eradication (Idaho)

Results of the study in summary are:

1. Experience is of no appreciable value in hand pulling of Ribes.

2. Aptitude and ability of men determine crew efficiency.

3. Where string lines are laid, 3- or 4-man crews are more efficient than larger crews.

4. 3-man crews are slightly more efficient than 4-man crews.

5. Generally, slopes are more advantageously worked in up and down hill directions rather than on contours.

6. Crew counts of numbers of Ribes pulled is sufficiently accurate for data requirements.

7. Foreman working in line with crew, pulling Ribes with them, is more advantageous than behind line.

8. Checking for missed Ribes independently of crew work indicates that it is possible for 1 man to check in 1 day the work performed in 16 to 32 man days with a final efficiency of 96 to 99% on the area.

9. Independent checking shows higher per cent of bushes pulled by checker than by the method of foreman behind-the-line.

10. One trench pick per crew is sufficient to meet the demand for tools.

11. Efficiency of the "Scout Crew" method depends on quality of men and rate of travel.

B. Chemical Eradication of Ribes.

Work carried out during the past year at Haugan, Montana and Bovill, Idaho shows the following:

1. The area covered by one man working alone with knapsack and hand pump by the "individual block method" was found to be three times greater than the area covered by one man when working in a crew. This difference occurred in all Ribes concentrations of 1% and over.

2. Lower costs are indicated per acre by the "individual block method" compared to the "crew method" in power equipment spraying. Further experimentation necessary for conclusive data.

3. Experiments with power spraying equipment indicate greater costs per acre than with knapsack spraying, especially in the lighter Ribes concentrations. Further experimentation necessary for conclusive data.

V. Pre-eradication Work.

A. Pre-eradication work done during the fall of the past year as a preliminary step for 1929 control demonstration as follows:

1. 8,640 acres were pre-eradicated on the Plumas National Forest, in California at a cost of $0.055 per acre.

2. Stream type classification based on method of work to be used made on all streams in 90,000 acres of the Musselshell District of the Clearwater National Forest in Idaho.